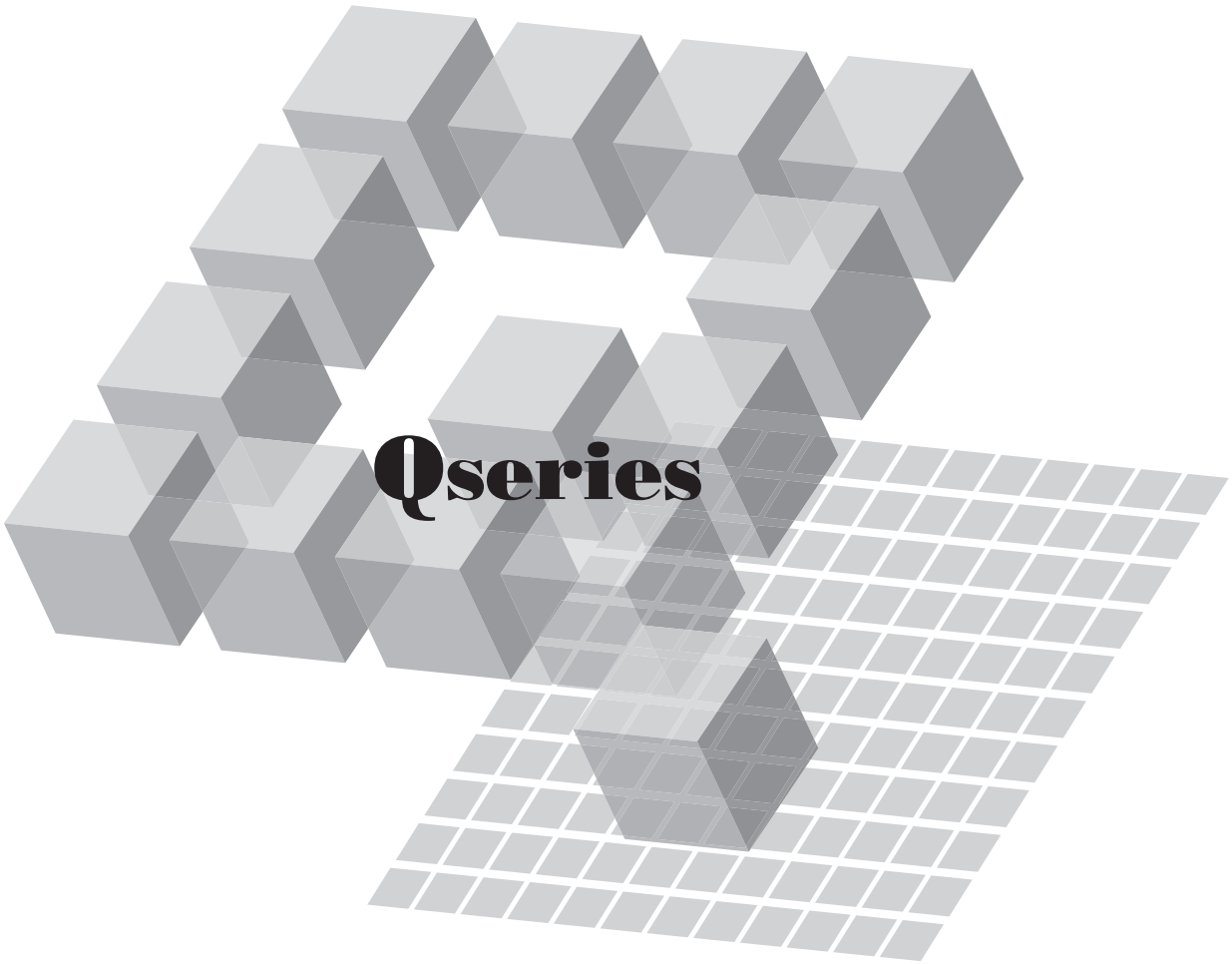
MITSUBISHI

Mitsubishi Programmable Controller

MELSEC Q series

# MELSEC-Q QD73A1 Positioning Module User's Manual




MODEL

*-QD73A1*

# ●SAFETY PRECAUTIONS●

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the user's manual for the CPU module used.

In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

| | |
|---|---|
| ⚠WARNING | Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury. |
| ⚠CAUTION | Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage. |

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

## [Design Precautions]

### ⚠WARNING

- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) When using a servo amplifier with Servo ON signal, connect the signal to the module. When using a servo amplifier whose control cannot be stopped through Servo ON signal, satisfy the following.
    • Analog voltage must be 0V (motor stop) to power off the programmable controller.
  (2) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.
  (3) OPR (Original Point Return) is controlled by two kinds of data: OPR direction and OPR speed. Deceleration starts when the near-point dog turns on. If an incorrect OPR direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the programmable controller.
- Do not write any data to the "system area" of the buffer memory in the intelligent function module. Also, do not use any "use prohibited" signal as an output signal from the CPU module to the intelligent function module. Doing so may cause malfunction of the programmable controller system.

| ⚠ CAUTION |
| --- |
| ● Do not install the connection cables for external I/O signals and for the drive unit together with the main circuit lines, power cables, or load circuit lines of a device other than the programmable controller.<br>Keep a distance of 100mm or more between them.<br>Failure to do so may result in malfunction due to noise, surges, and induction. |

## [Installation Precautions]

| ⚠ CAUTION |
| --- |
| ● Use the programmable controller in an environment that meets the general specifications in the user's manual for the CPU module used.<br>Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.<br>● To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection(s) into the hole(s) in the base unit and press the module until it snaps into place.<br>Incorrect mounting may cause malfunction, failure or drop of the module.<br>When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.<br>● Tighten the screws within the specified torque range.<br>Undertightening can cause drop of the screw, short circuit or malfunction.<br>Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.<br>● Securely connect the drive unit connector and external device connector to the connector on the module. Poor contact may cause incorrect input or output.<br>● Do not directly touch any conductive parts and electronic components of the module.<br>Doing so can cause malfunction or failure of the module.<br>● Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in damage to the product. |

## [Wiring Precautions]

### ⚠WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or cause the module to fail or malfunction.
- After installation and wiring, attach the included terminal cover to the module before turning it on for operation. Failure to do so may result in electric shock.

### ⚠CAUTION

- Check the rated voltage and terminal layout before wiring to the module, and connect the cables correctly.
  Connecting a power supply with a different voltage rating or incorrect wiring may cause a fire or failure.
- Use applicable solderless terminals and tighten them within the specified torque range.
  If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Tighten the connector screws within the specified torque range.
  Undertightening can cause short circuit, fire, or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- Connectors for external devices must be crimped with the tool specified by the manufacturer or must be correctly soldered.
  Incomplete connections may cause short circuit, fire, or malfunction.
- Place the cables in a duct or clamp them.
  If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable.
  Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.

## [Startup and Maintenance Precautions]

**⚠ WARNING**

- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the connector screws. Failure to do so may result in electric shock.

**⚠ CAUTION**

- Do not disassemble or modify the module.
  Doing so may cause failure, malfunction, injury, or a fire.
- Shut off the external power supply (all phases) used in the system before mounting or removing a module. Failure to do so may cause the module to fail or malfunction.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit may cause malfunction.
- Before testing operation, set a low speed value for the speed limit parameter so that the operation can be stopped immediately upon occurrence of a hazardous condition.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.

## [Precaution during operation]

**⚠ CAUTION**

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.

## [Disposal Precaution]

**⚠ CAUTION**

- When disposing of this product, treat it as industrial waste.

# ●CONDITIONS OF USE FOR THE PRODUCT●

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

# INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC-Q series programmable controllers.
This manual describes the operating procedure, system configuration, parameter settings, functions, programming, and troubleshooting of the QD73A1 positioning module (hereafter abbreviated as QD73A1).

Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC-Q series programmable controller to handle the product correctly.
When applying the program examples introduced in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.

■Relevant module: QD73A1

**Remark**

- Unless otherwise specified, this manual describes the program examples in which the I/O numbers of X/Y10 to X/Y2F are assigned for the QD73A1.
  For I/O number assignment, refer to the following manuals.
  - QnUCPU Users Manual (Function Explanation, Program Fundamentals)
  - Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)
- Operating procedures are explained using GX Works2. When using GX Developer, refer to the following.
  Page 271, Appendix 4

# COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

## (1) Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.

- QCPU User's Manual (Hardware Design, Maintenance and Inspection)
- Safety Guidelines
  (This manual is included with the CPU module or base unit.)

The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

## (2) Additional measures

To ensure that this product maintains EMC and Low Voltage Directives, please refer to Page 65, Section 4.6.1.

### (3) CPU module user's manual

| Manual name <manual number (model code)> | Description |
|---|---|
| QCPU User's Manual (Hardware Design, Maintenance and Inspection) <SH-080483ENG, 13JR73> | Specifications of the hardware (CPU modules, power supply modules, base units, extension cables, and memory cards), system maintenance and inspection, troubleshooting, and error codes |
| QnUCPU Users Manual (Function Explanation, Program Fundamentals) <SH-080807ENG, 13JZ27> | Functions, methods, and devices for programming |
| Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals) <SH-080808ENG, 13JZ28> | |

### (4) Operating manual

| Manual name <manual number (model code)> | Description |
|---|---|
| GX Works2 Version1 Operating Manual (Common) <SH-080779ENG, 13JU63> | System configuration, parameter settings, and online operations (common to Simple project and Structured project) of GX Works2 |
| GX Developer Version 8 Operating Manual <SH-080373E, 13JU41> | Operating methods of GX Developer, such as programming, printing, monitoring, and debugging |

## Memo

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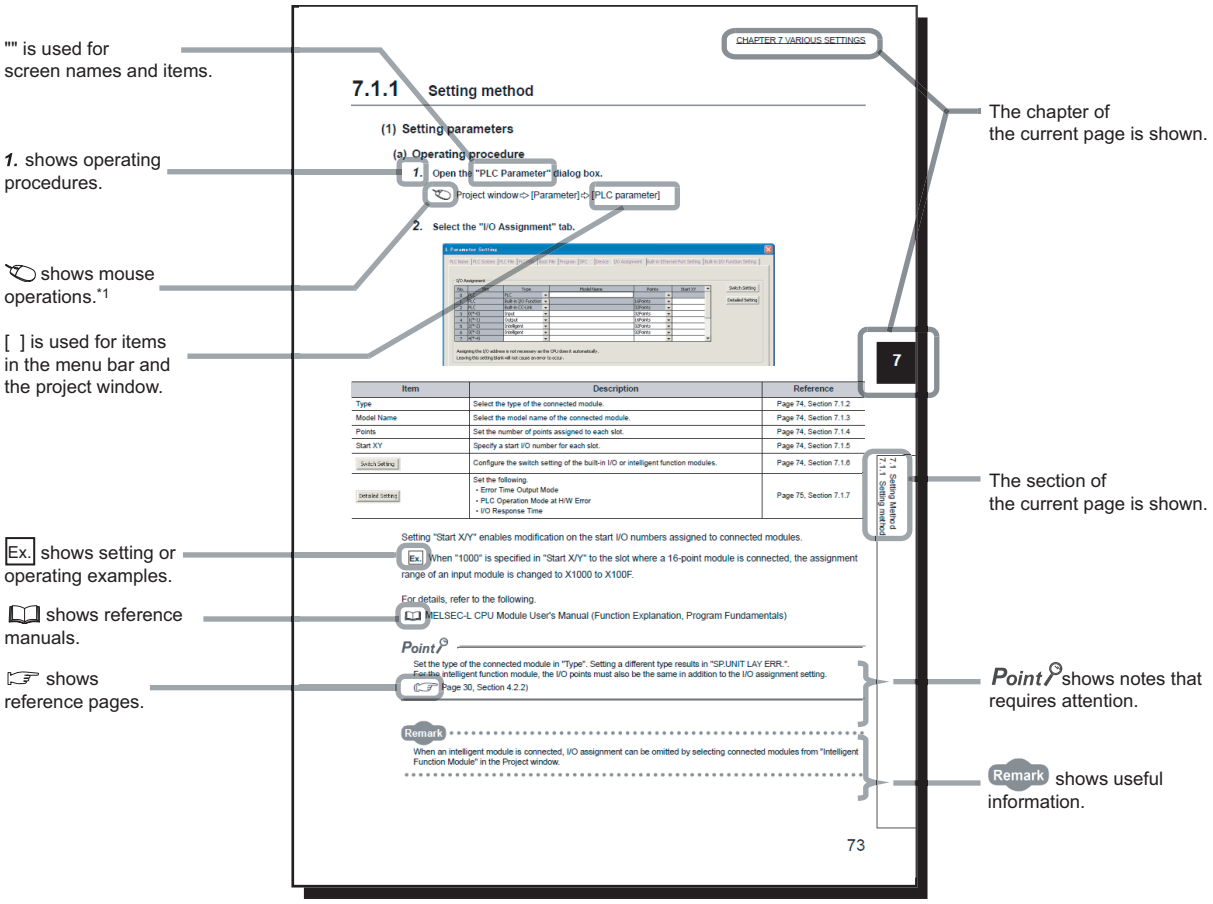
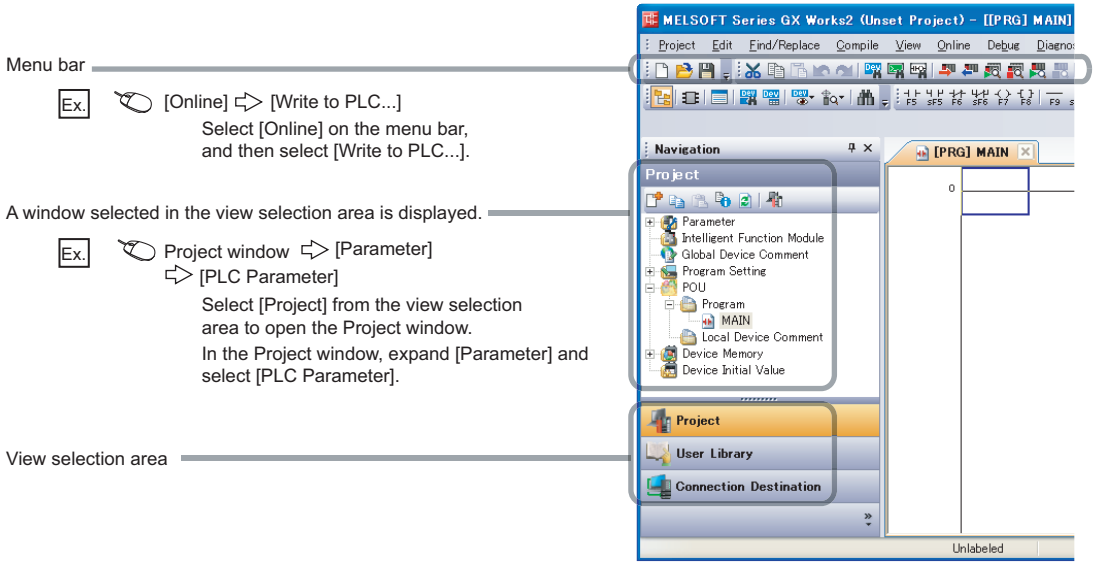
# MANUAL PAGE ORGANIZATION

In this manual, pages are organized and the symbols are used as shown below.
The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.


"" is used for screen names and items.
1. shows operating procedures.
shows mouse operations.*1
[ ] is used for items in the menu bar and the project window.
Ex. shows setting or operating examples.
shows reference manuals.
shows reference pages.
CHAPTER 7 VARIOUS SETTINGS
7.1.1 Setting method
(1) Setting parameters
(a) Operating procedure
1. Open the "PLC Parameter" dialog box.
Project window => [Parameter] => [PLC parameter]
2. Select the "I/O Assignment" tab.
Item
Description
Reference
Type
Model Name
Points
Start XY
Switch Setting
Detailed Setting
Set the following.
• Error Time Output Mode
• PLC Operation Mode at H/W Error
• I/O Response Time
Setting "Start X/Y" enables modification on the start I/O numbers assigned to connected modules.
Ex. When "1000" is specified in "Start X/Y" to the slot where a 16-point module is connected, the assignment range of an input module is changed to X1000 to X100F.
For details, refer to the following.
MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)
Point
Set the type of the connected module in "Type". Setting a different type results in "SP.UNIT LAY ERR.".
For the intelligent function module, the I/O points must also be the same in addition to the I/O assignment setting.
Page 30, Section 4.2.2)
Remark
When an intelligent module is connected, I/O assignment can be omitted by selecting connected modules from "Intelligent Function Module" in the Project window.
7
7.1 Setting method
73
The chapter of the current page is shown.
The section of the current page is shown.
Point shows notes that requires attention.
Remark shows useful information.

*1 The mouse operation example is provided below.


Menu bar
Ex. [Online] => [Write to PLC...]
Select [Online] on the menu bar, and then select [Write to PLC...].
A window selected in the view selection area is displayed.
Ex. Project window => [Parameter] => [PLC Parameter]
Select [Project] from the view selection area to open the Project window.
In the Project window, expand [Parameter] and select [PLC Parameter].
View selection area
MELSOFT Series GX Works2 (Unset Project) - [[PRG] MAIN]
Project Edit Find/Replace Compile View Online Debug
Navigation
Project
Parameter
Intelligent Function Module
Global Device Comment
Program Setting
POU
Program
MAIN
Local Device Comment
Device Memory
Device Initial Value
Project
User Library
Connection Destination
[PRG] MAIN
Unlabeled

The following symbols are used to represent buffer memory areas in this manual. Serial numbers fit in "*".

| Symbol | Description |
|---|---|
| Pr.* | Symbol indicating positioning parameter and OPR parameter item |
| Da.* | Symbol indicating positioning data item |
| Md.* | Symbol indicating monitor data item |
| Cd.* | Symbol indicating control data item |

# TERMS

Unless otherwise specified, this manual uses the following terms.

| Term | Description |
|---|---|
| QD73A1 | The abbreviation for the QD73A1 positioning module |
| QCPU | Another term for the MELSEC-Q series CPU module |
| Redundant CPU | A generic term for the Q12PRHCPU and Q25PRHCPU |
| External input | The abbreviation for input from connectors for external devices |
| External output | The abbreviation for output to connectors for external devices |
| Programming tool | Generic term for GX Works2 and GX Developer |
| GX Works2 | The product name of the software package for the MELSEC programmable controllers |
| GX Developer | |
| Buffer memory | The memory of an intelligent function module used to store data (such as setting values and monitored values) for communication with a CPU module |

For terms related to positioning, refer to the following.

☞Page 274, Appendix 5

# PACKING LIST

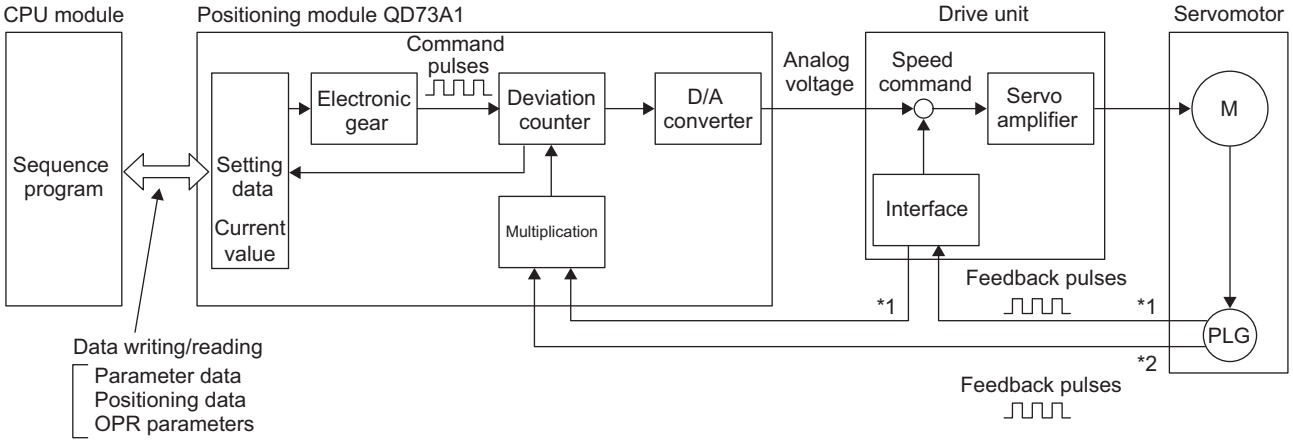
The product package contains the following.

| Model | Product | Quantity |
|---|---|---|
| QD73A1 | QD73A1 positioning module | 1 |
| QD73A1-U-HW | Before Using the Product | 1 |

# CHAPTER 1 OVERVIEW



The QD73A1 possesses a deviation counter and D/A converter inside as in the following figure.




Feedback pulses from the pulse generator (PLG) may be input to the QD73A1 via the drive unit*1 or directly*2 depending on the servomotor to be used.
Check which method applies in the manual for the servomotor or drive unit to be used.

A system with the QD73A1 operates as follows.

| | |
|---|---|
| Start | Once a command pulse train for positioning is output, pulses are accumulated in the deviation counter. The integrated value of pulses (accumulated pulses) is converted into DC analog voltage by a D/A converter, then turns into a speed command to a servomotor. The speed command from a drive unit starts servomotor rotation. |
| Operation | Once the servomotor starts rotating, feedback pulses that are proportional to the number of rotations are generated by a pulse generator (PLG) attached to the servomotor. The generated feedback pulses are subtracted from the accumulated pulses in the deviation counter. The deviation counter continues to rotate the servomotor, maintaining a constant amount of accumulated pulse. |
| Stop | Once the command pulse output from the QD73A1 stops, the accumulated pulses in the deviation counter decrease, so does the speed. When there is no more accumulated pulse, the servomotor stops. |

The rotation speed of a servomotor is proportional to command pulse frequency, while the rotation degree of the servomotor is proportional to the output command pulse amount. By setting feed per pulse beforehand, analog voltage that is proportional to the number of pulses in a pulse train is output, and a workpiece can be moved to the set position. Note that pulse frequency defines the rotation speed of the servomotor (feedrate).

# 1.1 Features

### (1) Analog output type that possesses a deviation counter and D/A converter inside

This module converts command pulse for positioning into analog voltage inside, then outputs a speed command to a servo amplifier.

### (2) Compatible with analog input servo amplifiers

A servo amplifier does not require an extra module to convert pulse input into analog voltage; a standard servo amplifier can be used.

### (3) Servomotor control using a high-resolution encoder

This module handles up to 1Mpulse/s of pulse input from an encoder. Servomotor control that uses high-speed input pulse signals from a high-resolution encoder improves the accuracy of positioning.

### (4) Four types of positioning method

The following control can be executed.

- Position control mode: positioning control and two-phase trapezoidal positioning control
- Speed-position control switch mode: speed-position control switchover and speed control

### (5) Zero/gain adjustment through a sequence program

Zero/gain adjustment can be performed through a sequence program. Therefore, the adjustment can be performed without using a switch or checking a LED, saving man-hour.
(Note that zero/gain adjustment can also be performed using switches on the front of the QD73A1.)

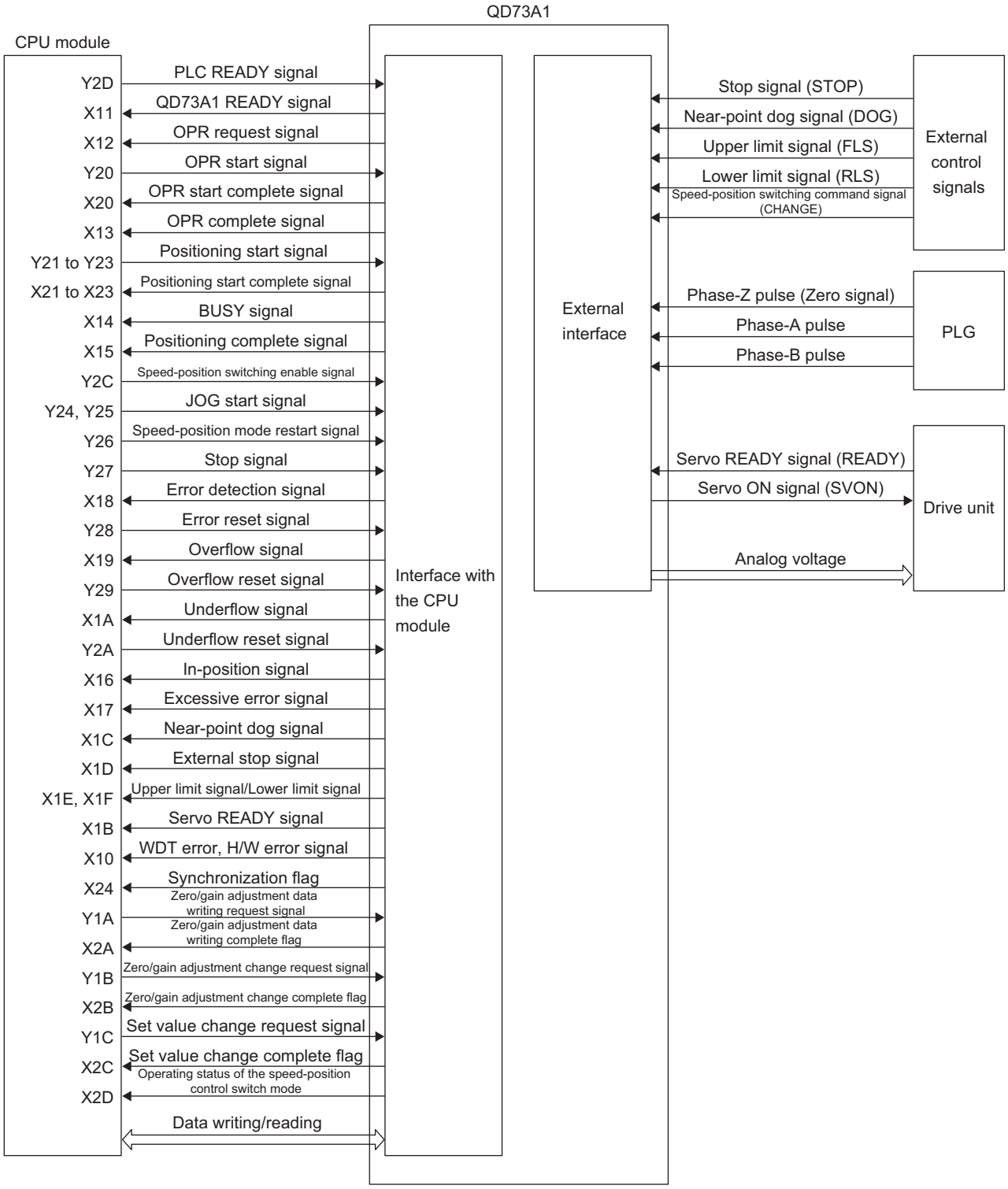
### (6) Easy setting with GX works2

Sequence programming is reduced since initial settings and the auto refresh setting can be configured on the screen. In addition, the setting status and operating status of the module can be checked easily.

# 1.2 Signal Transmission Between the QD73A1 and Others



The following figure shows signal transmission between the QD73A1 and a CPU module, and a drive unit.



### (1) Between the CPU module and the QD73A1

The CPU module and the QD73A1 transmit control signals and data to each other through the base unit.

| Transmitted item | Description | Reference |
|---|---|---|
| Control signal | Signals that indicate the QD73A1's status or are related to commands are transmitted. | Page 31, Section 3.4 |
| Data | Data is written to or read from the buffer memory in the QD73A1 by application instructions of the CPU module. | Page 74, CHAPTER 5 |

### (2) Between the drive unit and the QD73A1

Control signals are transmitted between the drive unit and the QD73A1, and speed commands (analog voltage) are output from the QD73A1 to the drive unit.

For details, refer to the following.

☞Page 41, Section 3.5

# CHAPTER 2 SYSTEM CONFIGURATION



This chapter describes the system configuration of the QD73A1.

## 2.1 Applicable Systems

This section describes applicable systems.

### (1) Applicable modules and base units, and number of mountable modules

The following table lists CPU modules and base units applicable to the QD73A1 and the number of mountable QD73A1.

Depending on the combination with other modules or the number of mounted modules, power supply capacity may be insufficient.

Select the power supply capacity according to the module to be used.

If the power supply capacity is insufficient, change the combination of the modules.

| Applicable CPU module | | | Number of modules*1 | Applicable base unit*2 | |
|---|---|---|---|---|---|
| CPU type | | CPU model | | Main base unit | Extension base unit |
| Programmable controller CPU | Basic model QCPU | Q00JCPU | Up to 5 | ○ | ○ |
| | | Q00CPU | Up to 12 | | |
| | | Q01CPU | | | |
| | High Performance model QCPU | Q02CPU | Up to 32 | ○ | ○ |
| | | Q02HCPU | | | |
| | | Q06HCPU | | | |
| | | Q12HCPU | | | |
| | | Q25HCPU | | | |
| | Process CPU | Q02PHCPU | Up to 32 | ○ | ○ |
| | | Q06PHCPU | | | |
| | | Q12PHCPU | | | |
| | | Q25PHCPU | | | |
| | Redundant CPU | Q12PRHCPU | Up to 26 | × | ○ |
| | | Q25PRHCPU | | | |
| | Universal model QCPU | Q00UJCPU | Up to 5 | ○ | ○ |
| | | Q00UCPU | Up to 12 | | |
| | | Q01UCPU | | | |
| | | Q02UCPU | Up to 18 | | |
| | | Q03UDCPU | Up to 32 | | |
| | | Q04UDHCPU | | | |
| | | Q06UDHCPU | | | |
| | | Q10UDHCPU | | | |
| | | Q13UDHCPU | | | |
| | | Q20UDHCPU | | | |
| | | Q26UDHCPU | | | |

| Applicable CPU module | | | Number of modules*1 | Applicable base unit*2 | |
|---|---|---|---|---|---|
| CPU type | | CPU model | | Main base unit | Extension base unit |
| Programmable controller CPU | Universal model QCPU | Q03UDECPU | Up to 32 | ○ | ○ |
| | | Q04UDEHCPU | | | |
| | | Q06UDEHCPU | | | |
| | | Q10UDEHCPU | | | |
| | | Q13UDEHCPU | | | |
| | | Q20UDEHCPU | | | |
| | | Q26UDEHCPU | | | |
| | | Q50UDEHCPU | | | |
| | | Q100UDEHCPU | | | |
| | Safety CPU | QS001CPU | N/A | × | ×*3 |
| C Controller module | | Q06CCPU-V | Up to 32 | ○ | ○ |
| | | Q06CCPU-V-B | | | |
| | | Q12DCCPU-V | | | |

○: Applicable, ×: N/A

*1 Limited within the range of I/O points for the CPU module.
*2 Can be mounted on any I/O slot of a base unit.
*3 Connection of an extension base unit is not available with any safety CPU.

**Remark**

To use a C Controller module with the QD73A1, refer to the C Controller Module User's Manual.

### (a) When mounted on MELSECNET/H remote I/O station

The following table lists the network modules and base units applicable to the QD73A1 and the number of mountable QD73A1.

Depending on the combination with other modules or the number of mounted modules, power supply capacity may be insufficient.

Select the power supply capacity according to the module to be used.

If the power supply capacity is insufficient, change the combination of the modules.

| Applicable network module | Number of modules*1 | Applicable base unit*2 | |
|---|---|---|---|
| | | Main base unit of remote I/O station | Extension base unit of remote I/O station |
| QJ72LP25-25 | Up to 32 | ○ | ○ |
| QJ72LP25G | | | |
| QJ72LP25GE | | | |
| QJ72BR15 | | | |

○: Applicable, ×: N/A

*1 Limited within the range of I/O points for the network module.
*2 Can be mounted on any I/O slot of a base unit.

**Remark**

The Basic model QCPU or C Controller module cannot configure the MELSECNET/ H remote I/O net.

## (2) Multiple CPU system

The function version of the first released QD73A1 is B, and the module supports multiple CPU systems.
When using the QD73A1 in a multiple CPU system, refer to the following.

QCPU User's Manual (Multiple CPU System)

### (a) Intelligent function module parameters

Write intelligent function module parameters to only the control CPU of the QD73A1.

## (3) Online module change

The QD73A1 does not support online module change.

## (4) Applicable software packages

The following table lists systems that use the QD73A1 and applicable software packages.
A programming tool is required to use the QD73A1.

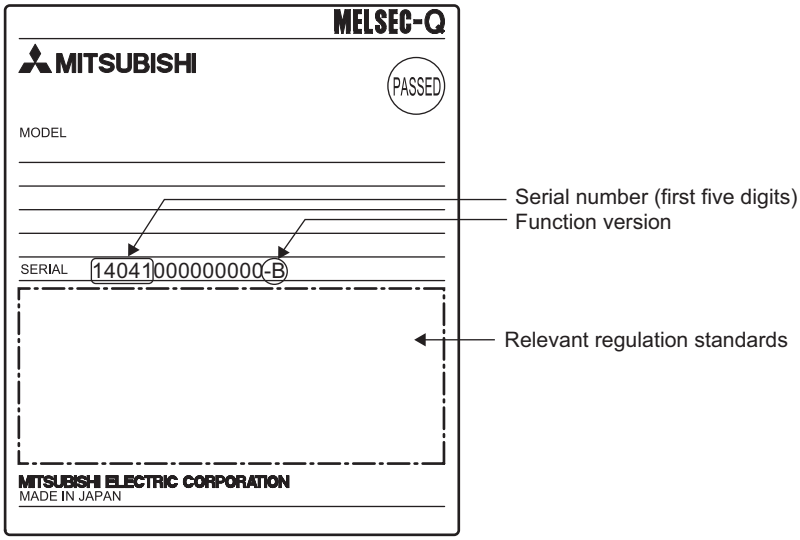
| Item | | Software version | |
|---|---|---|---|
| | | GX Works2 | GX Developer |
| Q00J/Q00/Q01CPU | Single CPU system | Version 1.87R or later | Version 7 or later |
| | Multiple CPU system | | Version 8 or later |
| Q02/Q02H/Q06H/Q12H/Q25HCPU | Single CPU system | | Version 4 or later |
| | Multiple CPU system | | Version 6 or later |
| Q02PH/Q06PHCPU | Single CPU system | | Version 8.68W or later |
| | Multiple CPU system | | |
| Q12PH/Q25PHCPU | Single CPU system | | Version 7.10L or later |
| | Multiple CPU system | | |
| Q12PRH/Q25PRHCPU | Redundant system | | Version 8.45X or later |
| Q00UJ/Q00U/Q01UCPU | Single CPU system | | Version 8.76E or later |
| | Multiple CPU system | | |
| Q02U/Q03UD/Q04UDH/Q06UDHCPU | Single CPU system | | Version 8.48A or later |
| | Multiple CPU system | | |
| Q10UDH/Q20UDHCPU | Single CPU system | | Version 8.76E or later |
| | Multiple CPU system | | |
| Q13UDH/Q26UDHCPU | Single CPU system | | Version 8.62Q or later |
| | Multiple CPU system | | |
| Q03UDE/Q04UDEH/Q06UDEH/Q13UDEH/ Q26UDEHCPU | Single CPU system | | Version 8.68W or later |
| | Multiple CPU system | | |
| Q10UDEH/Q20UDEHCPU | Single CPU system | | Version 8.76E or later |
| | Multiple CPU system | | |
| Q50UDEH/Q100UDEHCPU | Single CPU system | | N/A |
| | Multiple CPU system | | |
| When mounted on a MELSECNET/H remote I/O station | | | Version 6 or later |

# 2.2 How to Check the Function Version and Serial Number

The function version and serial number of the QD73A1 can be checked on the rating plate, front part of the module, or system monitor of the programming tool.

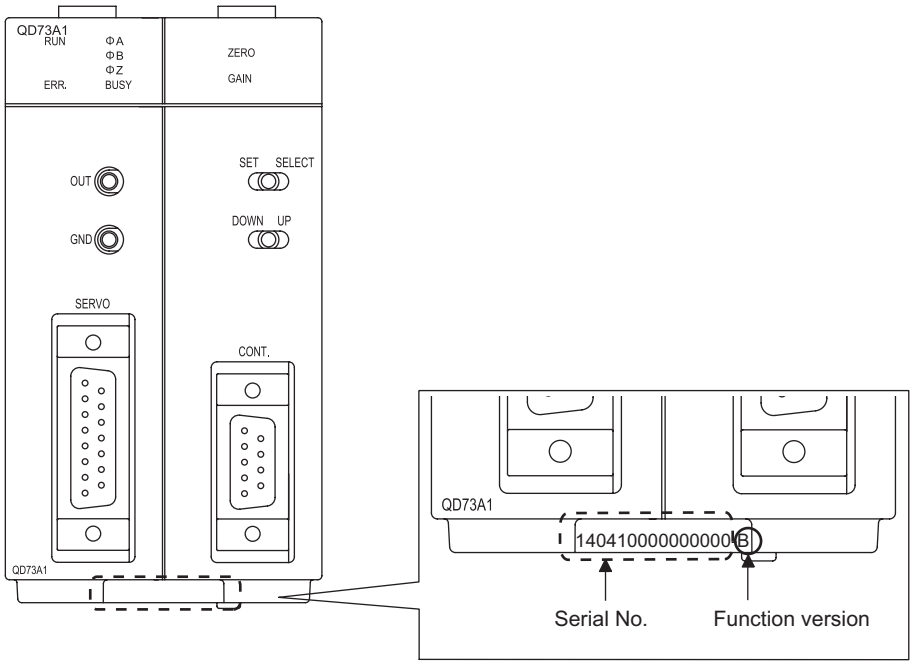
## (1) Checking on the rating plate

The rating plate is on the side of the QD73A1.




## (2) Checking on the front part (bottom part) of the module

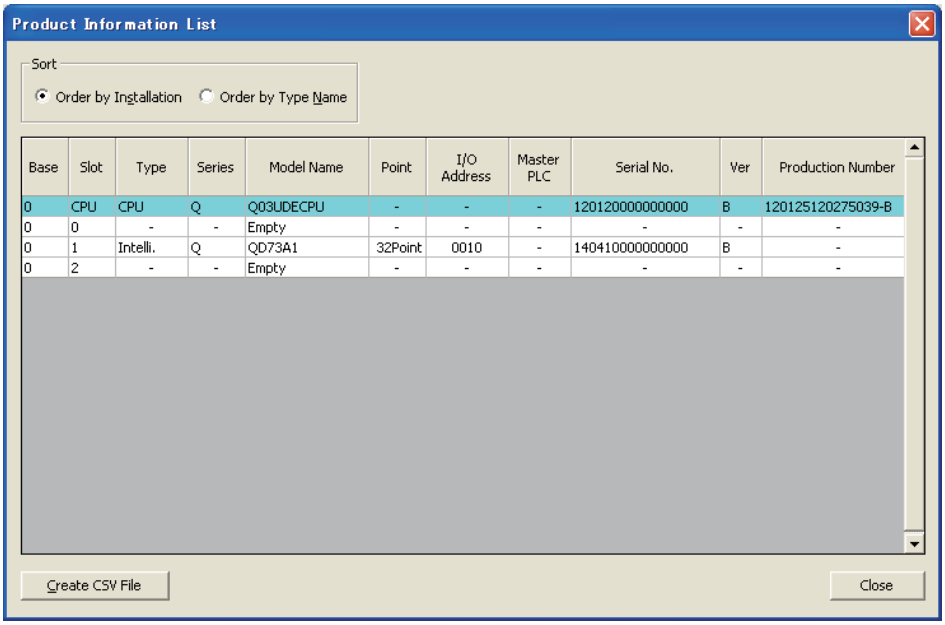
The function version and serial number on the rating plate are also shown on the front part (bottom part) of the module.



## (3) Checking on the system monitor

The function version and serial number can be checked on the "Product Information List" window.

[Diagnostics]⇨[System Monitor...]⇨ Product Information List button




**Point**

- The serial number displayed on the product information list of a programming tool may differ from that on the rating plate and on the front part of the module.
  - The serial number on the rating plate and front part of the module indicates the management information of the product.
  - The serial number displayed on the product information list of a programming tool indicates the function information of the product. The function information of the product is updated when a new function is added.

# CHAPTER 3 SPECIFICATIONS

This chapter describes performance specifications, I/O signals from/to the CPU module, and buffer memory specifications of the QD73A1.

For general specifications of the QD73A1, refer to the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

## 3.1 Performance Specifications

The following table lists performance specifications of the QD73A1.

| Item | | Specifications |
|---|---|---|
| Number of occupied I/O points | | 48 points (I/O assignment: empty 16 points and intelligent 32 points) |
| Number of control axes | | 1 axis |
| Positioning data | Capacity | 1 data |
| | Setting method | Sequence program |
| Positioning | Mode | Position control mode<br>Speed-position control switch mode |
| | System | Position control mode: Selectable from absolute system or incremental system<br>Speed-position control switch mode: Incremental system |
| | Position command | -2147483648 to 2147483647 (pulse) (signed 32-bit binary) |
| | Speed command | 1 to 4000000 (pulse/s) |
| | Acceleration | Automatic trapezoidal acceleration/deceleration |
| | Automatic acceleration/deceleration time | Acceleration time: 2 to 9999 (ms)<br>Deceleration time: 2 to 9999 (ms) |
| | In-position range | 1 to 20479 (pulse) |
| | Backlash compensation | None |
| | Error correction function | None |
| Speed command output | | 0 to ±10VDC (Adjustable to set in the range of ±5 to ±10VDC) |
| Positioning feedback pulse input | Pulse frequency | Open collector: 200kpulse/s<br>TTL: 200kpulse/s<br>Differential output: 1Mpulse/s |
| | Connectable encoder type | Open collector, TTL, or differential output |
| | Multiplication setting | The number of input feedback pulses can be multiplied by 4, 2, 1, or 1/2. |
| OPR control | | With OPR address change<br><br>An OPR method and OPR direction can be set through the intelligent function module switch setting. |
| JOG operation | | JOG operation can be started by inputting a JOG start signal. |
| M function | | None |
| Internal current consumption (5VDC) | | 0.52A |
| External supply voltage/current terminal block | | No external power supply |
| External dimensions | | 98(H)mm × 55.2(W)mm × 90(D)mm |
| Weight | | 0.20kg |
| Starting time<br>(from a start request to analog output start) | | Absolute system: 1.2ms (same for two-phase trapezoidal positioning)<br>Incremental system: 1.2ms (same for two-phase trapezoidal positioning)<br>JOG operation: 1.2ms<br>OPR (near-point dog method): 1.2ms<br>OPR (count method): 1.2ms |

# 3.2 Number of Parameter Settings

Set initial settings and auto refresh settings of the QD73A1 so that the number of parameters, including those of other intelligent function modules, does not exceed the number of parameters that can be set in the CPU module.
For the maximum number of parameters that can be set in the CPU module, refer to the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

## (1) Number of QD73A1 parameters

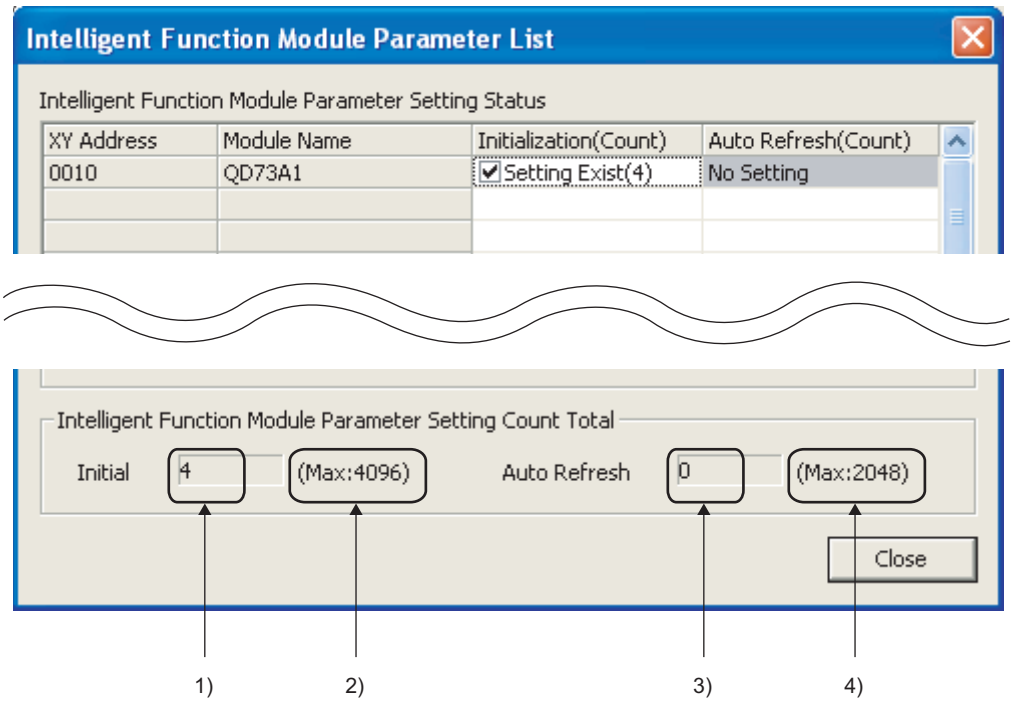
For a QD73A1, the following number of parameters can be set.

| Initial setting | Auto refresh setting |
|---|---|
| 4 | 5 |

## (2) Checking method

The maximum number of parameter settings and the number of parameter settings set for the intelligent function module can be checked on the following.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click
⇨ [Intelligent Function Module Parameter List...]




| No. | Description |
|---|---|
| 1) | The total number of parameters in initial settings checked on the window |
| 2) | The maximum number of parameter settings in initial settings |
| 3) | The total number of parameters in the auto refresh setting checked on the window |
| 4) | The maximum number of parameter settings in the auto refresh setting |

# 3.3 List of Functions

This section introduces the functions of the QD73A1.

## (1) Main functions

Major positioning functions are as follows.

| Item | | | Description | Reference |
|---|---|---|---|---|
| OPR control | | | A workpiece is returned to an original point following an OPR start command, and the current value is corrected as an OP address after the completion of OPR. | Page 176, CHAPTER 8 |
| Major positioning control | Position control mode | Positioning control | Positioning is executed from the current position to a specified position at a specified speed. | Page 189, Section 9.6.1 (1) |
| | | Two-phase trapezoidal positioning control | Positioning is executed to the address specified with " Da.2 Positioning address P1" at " Da.3 Positioning speed V1", then to the address specified with " Da.4 Positioning address P2" at " Da.5 Positioning speed V2" by one positioning start signal. | Page 190, Section 9.6.1 (2) |
| | Speed-position control switch mode | | Operation starts according to the positioning speed set beforehand by one positioning start signal, then the operation switches to position control by Speed-position switching command signal (CHANGE).<br>If the operation stopped by Stop signal after the input of Speed-position switching command signal (CHANGE), the positioning can be continued by requesting a restart.<br>In addition, the positioning address (movement amount) can be changed if it is before the input of Speed-position switching command signal (CHANGE). | Page 193, Section 9.6.2 |
| JOG operation | | | Positioning is executed in the specified direction at specified speed while a JOG operation command is on. Turning on the signal starts operation at a specified speed and speed control operation can be continued until a stop signal is input. | Page 198, CHAPTER 10 |

## (2) Sub functions

Sub functions compensate or limit control, or add functions at the execution of major positioning functions.

| Item | | Description | Reference |
|---|---|---|---|
| Functions to compensate control | Electronic gear function | This function controls moving distance and speed by multiplying command pulse output of the QD73A1. | Page 207, Section 11.1 |
| Functions to limit control | Speed limit function | This function limits command speed to the value set in " Pr.5 Speed limit value". | Page 209, Section 11.2 |
| | Stroke limit function | This function controls operation not to execute positioning when a command that moves the workpiece outside the specified stroke limit range is given. | Page 211, Section 11.3 |
| | Upper limit switch (FLS)/lower limit switch (RLS) function | This function decelerates and stops operation according to the detection on limit switches placed at the upper and lower stroke limits. | Page 213, Section 11.4 |

| Item | | Description | Reference |
|---|---|---|---|
| Functions to change control details | Current value change function | This function changes the value set in " Md.1 Current feed value" to a specified value. | Page 215, Section 11.5 |
| | Speed change function | This function changes speed during major positioning control or JOG operation. | Page 216, Section 11.6 |
| | Deviation counter clear function | This function clears the accumulated pulses in the deviation counter. When the servomotor power was turned off due to an emergency stop during positioning, clearing the accumulated pulses in the deviation counter prevents servomotor rotation at power recovery. | Page 218, Section 11.7 |
| Other functions | In-position function | This function turns on In-position signal (X16) while the accumulated pulse amount in the deviation counter is within the specified in-position range (1 to 20479pulse). In-position signal (X16) can be used as the signal right before positioning completion. | Page 219, Section 11.8 |
| | Multiplication setting | This function multiplies the feedback pulse frequency from the pulse generator by 4, 2, 1, or 1/2. | Page 104, Section 6.2.3 |
| | Accumulated pulse error detection function | This function outputs an alert and immediately stops the positioning when the accumulated pulses reached the amount specified by the user before the pulses exceed the amount set in "Accumulated pulse setting" in the switch setting and an excessive error occurs. | Page 221, Section 11.9 |

### (3) Common functions

Common functions can be used regardless of control method when necessary.

| Item | Description | Reference |
|---|---|---|
| Zero/gain adjustment | This function adjusts analog output voltage. | Page 60, Section 4.5 |
| Module status monitor function | This function monitors the module information, switch setting information, and external I/O signal information. The module's detailed information can be displayed on the system monitor of GX Works2. | Page 234, Section 13.1 |
| Error history function | This function monitors the QD73A1's error history stored in the buffer memory. | Page 236, Section 13.2 |
| Module error collection function | This function reports errors that occurred in the QD73A1 to the CPU module. The error information is held in the CPU module memory as a module error history. | Page 237, Section 13.3 |
| Error clear function | This function allows the user to clear errors on the system monitor. | Page 238, Section 13.4 |

## (4) Combination of main function and sub function

◎: Always used together, ○: Can be used together, ×: Cannot be used together

| Item | | | Functions to compensate control | Functions to limit control | | | Functions to change control details | | | Other functions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Electronic gear function | Speed limit function | Stroke limit function | Upper limit switch (FLS)/ lower limit switch (RLS) function | Current value change function | Speed change function | Deviation counter clear function | In-position function | Multiplication setting | Accumulated pulse error detection function |
| OPR control | | | ○ | ○ | ○ | ◎ | × | × | × | ○ | ○ | ○ |
| Major positioning control | Position control mode | Positioning control | ○ | ○ | ○ | ◎ | × | ○ | × | ○ | ○ | ○ |
| | | Two-phase trapezoidal positioning control | ○ | ○ | ○ | ◎ | × | ○ | × | ○ | ○ | ○ |
| | Speed-position control switch mode | | ○ | ○ | ○ | ◎ | × | ○ | × | ○ | ○ | ○ |
| JOG operation | | | ○ | ○ | ○ | ◎ | × | ○ | × | ○ | ○ | ○ |

# 3.4 I/O Signals from/to the CPU Module

This section describes I/O signals of the QD73A1.

## 3.4.1 I/O signal list

This section describes I/O signal assignment and use of each signal.
The first half of the I/O assignment is empty 16 points, and the second half is intelligent 32 points. When the module is mounted on the slot No.0 and 1 of a main base unit, the device No.Xn0 becomes X10. Although, when the slot No.0 is set as empty 0 point in the I/O assignment setting of GX Works2, the device No.Xn0 becomes X0 (n=0).
Device numbers used in this manual are for the case when the QD73A1 is mounted on the slot No.0 and 1 and when the slot No.0 is empty 16 points.

### (1) Input signal list

| Input signal (CPU module ← QD73A1) | | Input signal (CPU module ← QD73A1) | |
|---|---|---|---|
| **Device No.** | **Signal name** | **Device No.** | **Signal name** |
| X10 | WDT error, H/W error signal | X20 | OPR start complete signal |
| X11 | QD73A1 READY signal | X21 | Absolute positioning start complete signal |
| X12 | OPR request signal | X22 | Forward start complete signal |
| X13 | OPR complete signal | X23 | Reverse start complete signal |
| X14 | BUSY signal | X24 | Synchronization flag |
| X15 | Positioning complete signal | X25 | Use prohibited |
| X16 | In-position signal | X26 | |
| X17 | Excessive error signal | X27 | |
| X18 | Error detection signal | X28 | |
| X19 | Overflow signal | X29 | |
| X1A | Underflow signal | X2A | Zero/gain adjustment data writing complete flag |
| X1B | Servo READY signal | X2B | Zero/gain adjustment change complete flag |
| X1C | Near-point dog signal | X2C | Set value change complete flag |
| X1D | External stop signal | X2D | Operating status of the speed-position control switch mode |
| X1E | Upper limit signal | X2E | Use prohibited |
| X1F | Lower limit signal | X2F | |

**Point**

If a "Use prohibited" area is turned on/off through a sequence program, the QD73A1's function cannot be guaranteed.

### (2) Output signal list

| Output signal (CPU module → QD73A1) | | Output signal (CPU module → QD73A1) | |
|---|---|---|---|
| **Device No.** | **Signal name** | **Device No.** | **Signal name** |
| Y10 | Use prohibited | Y20 | OPR start signal |
| Y11 | | Y21 | Absolute positioning start signal |
| Y12 | | Y22 | Forward start signal |
| Y13 | | Y23 | Reverse start signal |
| Y14 | | Y24 | Forward JOG start signal |
| Y15 | | Y25 | Reverse JOG start signal |
| Y16 | | Y26 | Speed-position mode restart signal |
| Y17 | | Y27 | Stop signal |
| Y18 | | Y28 | Error reset signal |
| Y19 | | Y29 | Overflow reset signal |
| Y1A | Zero/gain adjustment data writing request signal | Y2A | Underflow reset signal |
| Y1B | Zero/gain adjustment change request signal | Y2B | Use prohibited |
| Y1C | Set value change request signal | Y2C | Speed-position switching enable signal |
| Y1D | Use prohibited | Y2D | PLC READY signal |
| Y1E | | Y2E | Use prohibited |
| Y1F | | Y2F | |

**Point**

If a "Use prohibited" area is turned on/off through a sequence program, the QD73A1's function cannot be guaranteed.

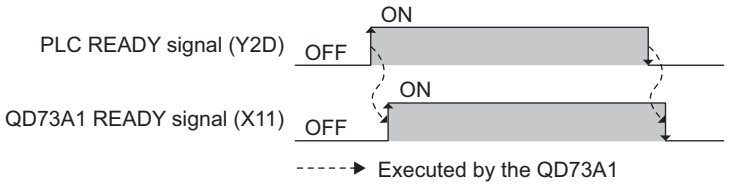
# 3.4.2 Details of input signals

## (1) WDT error, H/W error signal (X10)

This signal turns on when a watchdog timer error is detected through the self-diagnostic function of the QD73A1.
In this case, Servo ON signal (SVON) turns off and analog output becomes 0.

## (2) QD73A1 READY signal (X11)

When PLC READY signal (Y2D) is turned on through a sequence program, fixed parameters are checked and this signal turns on.
When PLC READY signal (Y2D) is turned off, this signal turns off.




Use this signal as an interlock in sequence programs.

## (3) OPR request signal (X12)

This signal turns on at any of the following timing.

- When the power is turned on
- When the CPU module was reset
- When OPR starts
- When Servo READY signal (READY) turns off while BUSY signal (X14) is on

This signal turns off when OPR is completed.
When PLC READY signal (Y2D) is turned on (rising edge), this signal does not turn on.

## (4) OPR complete signal (X13)

This signal turns on when OPR is completed.
This signal does not turn on if operation stopped during OPR.
This signal turns off when JOG operation or major positioning control is started.
In the count method, this signal turns off when OPR starts.

## (5) BUSY signal (X14)

This signal turns on when major positioning control, JOG operation, or OPR starts.
This signal turns off when command pulse output is completed.
If positioning is started while BUSY signal (X14) is on, the error "BUSY signal ON at start" (error code: 81) occurs.

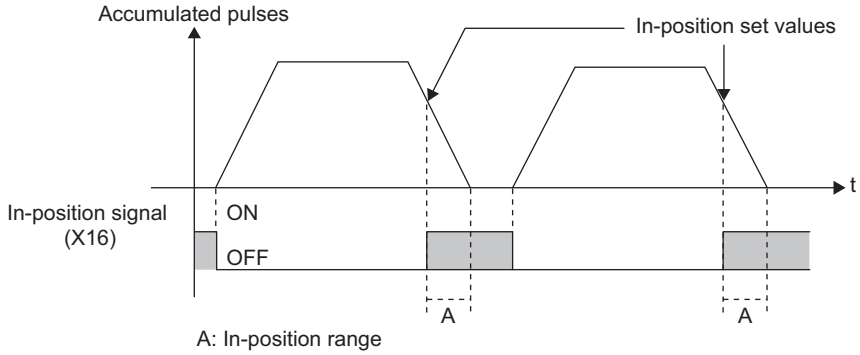
## (6) Positioning complete signal (X15)

This signal turns on when major positioning control is completed (completion of command pulse output).
This signal turns off when the next positioning (major positioning control, OPR, or JOG operation) starts.
If major positioning control was cancelled during its operation, this signal does not turn on.
For the operation in case of cancellation of major positioning control, refer to the following.

☞Page 228, Section 12.1

## (7) In-position signal (X16)

This signal turns on while the accumulated pulse amount in the deviation counter is within the set range of "Pr.8 In-position range" (1 to ±20479) after deceleration started.
This signal turns off when positioning starts.




Accumulated pulse amount are checked being compared with "Pr.8 In-position range" at the following timing.

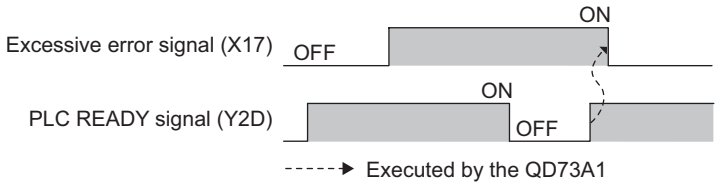
- When the power is turned on
- When automatic deceleration starts in positioning, and thereafter
- When a JOG start signal was turned off and deceleration starts in JOG operation, and thereafter
- When the near-point dog turned on and deceleration to the creep speed starts in OPR, and thereafter

## (8) Excessive error signal (X17)

This signal turns on when accumulated pulse amount exceeds the accumulated pulse setting range.
In this case, the QD73A1's status is as follows.

- Analog output voltage: 0V
- Accumulated pulse: Reset to 0
- Servo ON signal (SVON): OFF
- Md.2 Actual current value = Md.1 Current feed value

When PLC READY signal (Y2D) is turned on, this signal turns off.



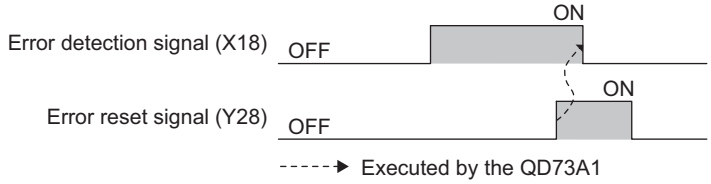

Even if this signal turns on, Error detection signal (X18) does not turn on.
For the accumulated pulse setting range, refer to the following.

☞Page 102, Section 6.2.2

## (9) Error detection signal (X18)

When a major or minor error occurs, the corresponding error code is stored in the buffer memory, and this signal turns on.

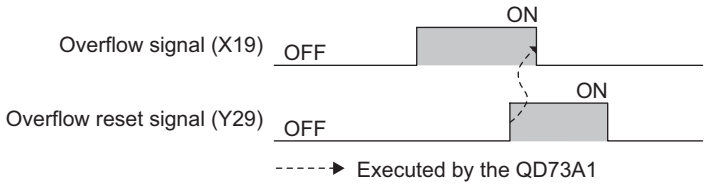
When Error reset signal (Y28) is turned on, this signal turns off.




## (10)Overflow signal (X19)

This signal turns on when "Md.1 Current feed value" exceeds 2147483647.

When Overflow reset signal (Y29) is turned on, this signal turns off.

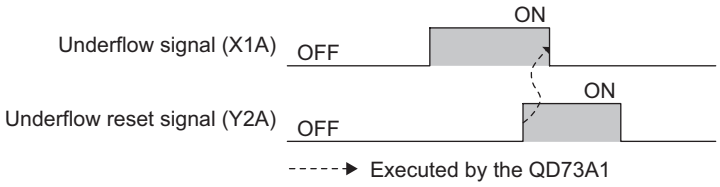



In case of an overflow, "Md.1 Current feed value" changes as follows: 2147483647 → -2147483648

## (11)Underflow signal (X1A)

This signal turns on when "Md.1 Current feed value" becomes less than -2147483648.

When Underflow reset signal (Y2A) is turned on, this signal turns off.




In case of an underflow, "Md.1 Current feed value" changes as follows: -2147483648 → 2147483647

## (12)Servo READY signal (X1B)

This signal indicates the on/off status of Servo READY signal (READY).

## (13)Near-point dog signal (X1C)

This signal indicates the on/off status of Near-point dog signal (DOG).

## (14)External stop signal (X1D)

This signal indicates the on/off status of Stop signal (STOP).

## (15)Upper limit signal (X1E)

This signal indicates the on/off status of Upper limit signal (FLS).

## (16)Lower limit signal (X1F)

This signal indicates the on/off status of Lower limit signal (RLS).

## (17)OPR start complete signal (X20)

This signal turns on when OPR process starts after OPR start signal (Y20) was turned on.
When OPR start signal (Y20) is turned off after the start of OPR, this signal turns off.

## (18)Absolute positioning start complete signal (X21)

This signal turns on when positioning process starts after Absolute positioning start signal (Y21) was turned on.
When Absolute positioning start signal (Y21) is turned off after the start of the positioning, this signal turns off.

## (19)Forward start complete signal (X22)

This signal turns on when positioning process starts after Forward start signal (Y22) was turned on.
When Forward start signal (Y22) is turned off after the start of the positioning, this signal turns off.

## (20)Reverse start complete signal (X23)

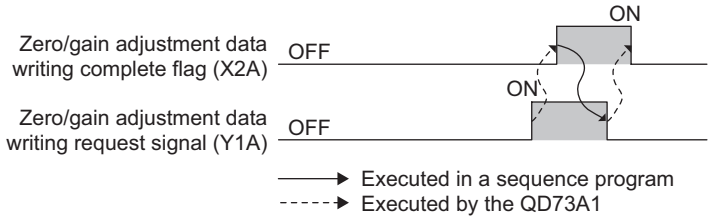
This signal turns on when positioning process starts after Reverse start signal (Y23) was turned on.
When Reverse start signal (Y23) is turned off after the start of the positioning, this signal turns off.

## (21)Synchronization flag (X24)

This signal turns on when the CPU module becomes accessible to the QD73A1 after the power was turned off then on, or after the CPU module was reset.
When the module synchronization setting of the CPU module is set to asynchronous, use this signal as an interlock to access the QD73A1 from a sequence program.

## (22)Zero/gain adjustment data writing complete flag (X2A)

This signal turns on when zero/gain adjustment value writing to the QD73A1 is completed after Zero/gain adjustment data writing request signal (Y1A) was turned on.
When Zero/gain adjustment data writing request signal (Y1A) is turned off, this signal turns off.



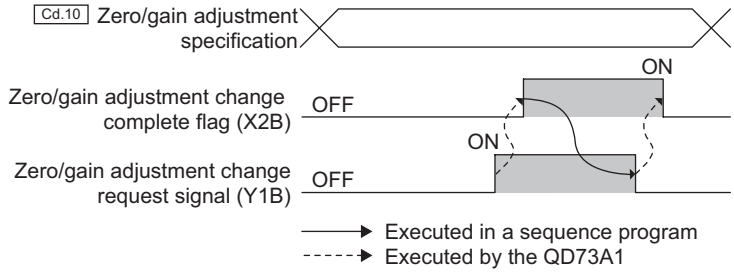

Use this signal as an interlock condition to turn on/off Zero/gain adjustment data writing request signal (Y1A) when writing the zero/gain adjustment value to the QD73A1.
For details on zero/gain adjustment, refer to the following.

☞Page 60, Section 4.5

## (23)Zero/gain adjustment change complete flag (X2B)

This signal turns on when zero adjustment and gain adjustment were switched after Zero/gain adjustment change request signal (Y1B) was turned on.

When Zero/gain adjustment change request signal (Y1B) is turned off, this signal turns off.




Use this signal as an interlock condition to turn on/off Zero/gain adjustment change request signal (Y1B) when changing "Cd.10 Zero/gain adjustment specification".

For details on zero/gain adjustment, refer to the following.

☞Page 60, Section 4.5

## (24)Set value change complete flag (X2C)

This signal turns on when the analog output value of zero/gain adjustment was changed after Set value change request signal (Y1C) was turned on.

When Set value change request signal (Y1C) is turned off, this signal turns off.

Use this signal as an interlock condition to turn on/off Set value change request signal (Y1C) when performing zero/gain adjustment.

For details on zero/gain adjustment, refer to the following.

☞Page 60, Section 4.5

## (25)Operating status of the speed-position control switch mode (X2D)

This signal indicates the operating status in the speed-position control switch mode.

This signal is on during speed control.

This signal is off during position control.

# 3.4.3 Details of output signals

## (1) Zero/gain adjustment data writing request signal (Y1A)

Turn on this signal to write the zero/gain adjustment value to the QD73A1.

For the on/off timing of this signal, refer to the detail of Zero/gain adjustment data writing complete flag (X2A). (☞Page 36, Section 3.4.2 (22))

For details on zero/gain adjustment, refer to the following.

☞Page 60, Section 4.5

## (2) Zero/gain adjustment change request signal (Y1B)

Turn on this signal to change zero adjustment and gain adjustment.

For the on/off timing of this signal, refer to the detail of Zero/gain adjustment change complete flag (X2B). (☞Page 37, Section 3.4.2 (23))

For details on zero/gain adjustment, refer to the following.

☞Page 60, Section 4.5

## (3) Set value change request signal (Y1C)

Turn on/off this signal to increase/decrease the analog output value at zero/gain adjustment.

The analog output is increased/decreased according to the value set in "Cd.11 Zero/gain adjustment value specification".

For the on/off timing of this signal, refer to the detail of Set value change complete flag (X2C). (☞Page 37, Section 3.4.2 (24))

For details on zero/gain adjustment, refer to the following.

☞Page 60, Section 4.5

## (4) OPR start signal (Y20)

Turn on this signal to start OPR.

## (5) Absolute positioning start signal (Y21)

Turn on this signal to start absolute system positioning (position control mode).

## (6) Forward start signal (Y22)

Turn on this signal to start positioning in the address increasing direction.

The following table describes the consequence of turning on this signal for each type of positioning (major positioning control).

| Major positioning control | | Consequence of turning on Forward start signal (Y22) |
|---|---|---|
| Position control mode | Positioning control | Starts in the address increasing direction (incremental system) |
| | Two-phase trapezoidal positioning control | |
| Speed-position control switch mode | | Starts in the address increasing direction |

## (7) Reverse start signal (Y23)

Turn on this signal to start positioning in the address decreasing direction.
The following table describes the consequence of turning on this signal for each type of positioning (major positioning control).

| Major positioning control | | Consequence of turning on Reverse start signal (Y23) |
|---|---|---|
| Position control mode | Positioning control | Starts in the address decreasing direction (incremental system) |
| | Two-phase trapezoidal positioning control | |
| Speed-position control switch mode | | Starts in the address decreasing direction |

## (8) Forward JOG start signal (Y24)

Turn on this signal to start JOG operation in the address increasing direction.
The JOG operation continues while this signal is on.
The JOG operation decelerates and stops when this signal is turned off.

## (9) Reverse JOG start signal (Y25)

Turn on this signal to start JOG operation in the address decreasing direction.
The JOG operation continues while this signal is on.
The JOG operation decelerates and stops when this signal is turned off.

## (10) Speed-position mode restart signal (Y26)

Turn on this signal to restart positioning if it stopped due to Stop signal in the speed-position control switch mode.

## (11) Stop signal (Y27)

Turn on this signal to decelerate and stop OPR operation, major positioning operation, or JOG operation.
If this signal is turned on during OPR, Error detection signal (X18) turns on.

## (12) Error reset signal (Y28)

Turn on this signal to clear the following buffer memory data to 0 when Error detection signal (X18) is on.

- Md.3 Error code (ERR.1)
- Md.4 Error code (ERR.2)

When this signal is turned on, Error detection signal (X18) turns off.

## (13) Overflow reset signal (Y29)

Turn on this signal to turn off Overflow signal (X19) when it is on.
For the on/off timing of this signal, refer to the detail of Overflow signal (X19). (☞ Page 35, Section 3.4.2 (10))

## (14)Underflow reset signal (Y2A)

Turn on this signal to turn off Underflow signal (X1A) when it is on.

For the on/off timing of this signal, refer to the detail of Underflow signal (X1A). (☞Page 35, Section 3.4.2 (11))

## (15)Speed-position switching enable signal (Y2C)

Use this signal to enable/disable Speed-position switching command signal (CHANGE) in the speed-position control switch mode.

Turn on this signal to enable Speed-position switching command signal (CHANGE). Turn off this signal to disable Speed-position switching command signal (CHANGE).

## (16)PLC READY signal (Y2D)

This signal notifies the QD73A1 that the CPU module is operating normally.

This signal needs to be turned on beforehand to start OPR, major positioning, or JOG operation.

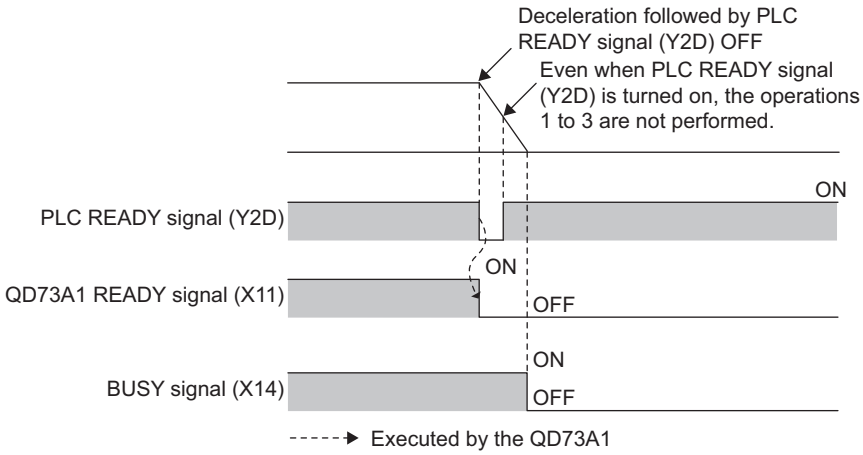
This signal needs to be turned off beforehand to write fixed parameters and OPR parameters.

When this signal is turned on, the QD73A1 performs the following.

- 1: Checking fixed parameters
- 2: Turning on QD73A1 READY signal (X11)
- 3: Turning off Excessive error signal (X17) when it is on

When this signal is turned off while BUSY signal (X14) is on, the QD73A1 processes a deceleration stop.

When this signal is turned on while BUSY signal (X14) is on, the QD73A1 does not perform the operations 1 to 3 above.


Deceleration followed by PLC READY signal (Y2D) OFF
Even when PLC READY signal (Y2D) is turned on, the operations 1 to 3 are not performed.
PLC READY signal (Y2D)
ON
QD73A1 READY signal (X11)
ON
OFF
BUSY signal (X14)
ON
OFF
Executed by the QD73A1

# 3.5 Specifications of I/O Interfaces with External Devices

This section describes I/O interfaces between the QD73A1 and external devices.

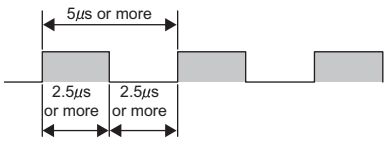
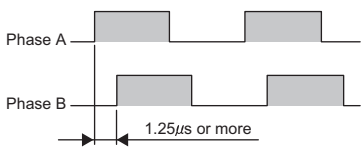
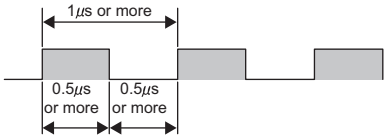
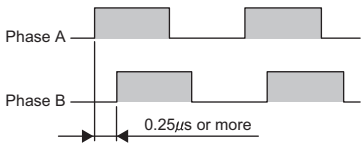
## 3.5.1 Electrical specifications of I/O signals

This section describes electrical specifications of I/O interfaces between the QD73A1 and external devices.

### (1) Input specifications

| Signal name | | Voltage range/Current consumption | ON voltage | ON current | OFF voltage | OFF current | Pulse frequency |
|---|---|---|---|---|---|---|---|
| Supply power | Input common | 5 to 24VDC/ Max.60mA | — | — | — | — | — |
| Servo READY signal (READY)<br>Stop signal (STOP)<br>Near-point dog signal (DOG)<br>Upper limit signal (FLS)<br>Lower limit signal (RLS)<br>Speed-position switching command signal (CHANGE) | | 4.75 to 26.4VDC | 3V or higher | 2.5mA or higher | 1V or lower | 0.1mA or lower | — |
| (Open collector method)<br>Phase-A feedback pulse (PULSE A)<br>Phase-B feedback pulse (PULSE B)<br>Phase-Z feedback pulse (PULSE Z) | | 10.8 to 14VDC | 4V or higher | 2.7mA or higher | 1V or lower | 0.1mA or lower | 200kpulse/s or less*1 |
| (TTL method)<br>Phase-A feedback pulse (PULSE A)<br>Phase-B feedback pulse (PULSE B)<br>Phase-Z feedback pulse (PULSE Z) | | 4.5 to 5.5VDC | 2.8V or higher | — | 0.8V or lower | — | 200kpulse/s or less*1 |
| (Differential output method)<br>Phase-A feedback pulse (PULSE A)<br>Phase-B feedback pulse (PULSE B)<br>Phase-Z feedback pulse (PULSE Z) | | — | EIA standard<br>RS-422-A differential line receiver<br>(Equivalent of AM26LS32 (Manufactured by Texas Instruments Inc.)) | | | | 1Mpulse/s or less*1 |

*1 The following table shows the pulse width and phase difference depending on pulse frequency.

| Pulse frequency | Pulse width (duty ratio: 50%) | Phase difference | |
|---|---|---|---|
| 200kpulse/s or less |  |  | When the phase A leads the phase B, the positioning address (current value) increases. |
| 1Mpulse/s or less |  |  | |

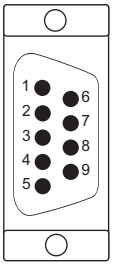
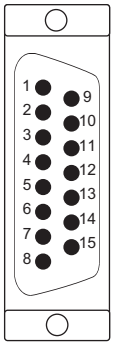
## (2) Output specifications

| Signal name | Analog output voltage/current | Output method | Load voltage | Load current | Max. voltage drop at ON | Leakage current at OFF |
|---|---|---|---|---|---|---|
| Servo ON signal (SVON) | — | Open collector | 4.75 to 26.4VDC | Max.30mA*1 | 1.0V or lower | 0.1mA or lower |
| Speed command signal (analog signal) | 0 to ±10VDC/10mA | — | — | — | — | — |

*1 The load current of Servo ON signal (SVON) is 30mA at the maximum. When using a miniature relay, take the load current into consideration.

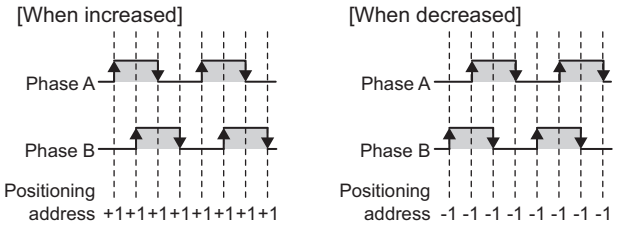
# 3.5.2 Signal layout for external device connectors

The following table shows signal layouts on external device connectors.

| Connector name | Pin arrangement | Pin number | Signal name |
|---|---|---|---|
| CONT. |  Viewed from the front of the module | 1 | Near-point dog signal (DOG) |
| | | 2 | Empty |
| | | 3 | Empty |
| | | 4 | Empty |
| | | 5 | Power supply (5 to 24V) |
| | | 6 | Lower limit signal (RLS) |
| | | 7 | Upper limit signal (FLS) |
| | | 8 | Speed-position switching command signal (CHANGE) |
| | | 9 | Stop signal (STOP) |
| SERVO |  Viewed from the front of the module | 1 | Servo READY signal (READY) (+ side) |
| | | 2 | Servo READY signal (READY) (- side) |
| | | 3 | Servo ON signal (SVON) (+ side) |
| | | 4 | Servo ON signal (SVON) (- side) |
| | | 5 | Phase-B feedback pulse (PULSE B) (+ side) |
| | | 6 | Phase-Z feedback pulse (PULSE Z) (+ side) |
| | | 7 | Phase-Z feedback pulse (PULSE Z) (- side) |
| | | 8 | Empty |
| | | 9 | Analog GND |
| | | 10 | Phase-B feedback pulse (PULSE B) (- side) |
| | | 11 | Phase-A feedback pulse (PULSE A) (- side) |
| | | 12 | Empty |
| | | 13 | Phase-A feedback pulse (PULSE A) (+ side) |
| | | 14 | Speed command signal (- side) |
| | | 15 | Speed command signal (+ side) |

## 3.5.3 List of I/O signal details

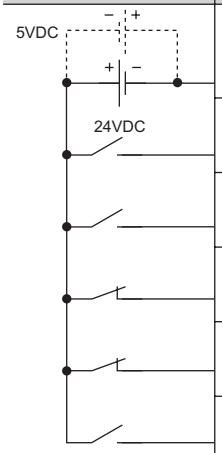
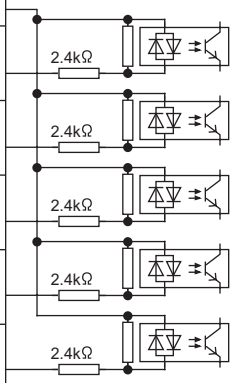
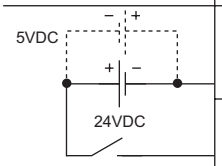
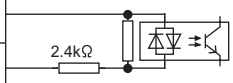
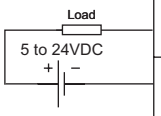
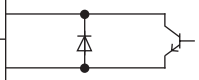
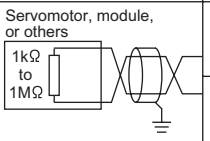
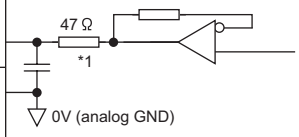
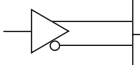
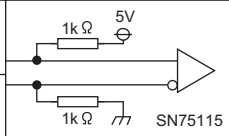
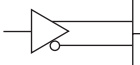
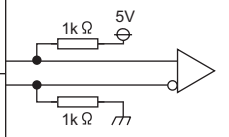
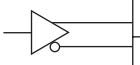
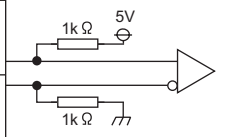
This section describes details of signals that are input or output through external device connectors on the QD73A1.

| Signal name | Connector name | Pin number | Signal detail |
|---|---|---|---|
| Phase-A feedback pulse (PULSE A) (+ side)<br>Phase-B feedback pulse (PULSE B) (+ side)<br>Phase-Z feedback pulse (PULSE Z) (+ side) | SERVO | 13<br>5<br>6 | • Feedback pulse signals of encoder's phases A, B, and Z are input.<br>• When the phase A leads the phase B, the positioning address increases at the rising and falling edges of each phase.<br>• When the phase B leads the phase A, the positioning address decreases at the rising and falling edges of each phase. |
| Phase-A feedback pulse (PULSE A) (- side)<br>Phase-B feedback pulse (PULSE B) (- side)<br>Phase-Z feedback pulse (PULSE Z) (- side) | | 11<br>10<br>7 |  |
| Analog GND | | 9 | — |
| Upper limit signal (FLS) | CONT. | 7 | • This signal is input from the limit switch placed at stroke upper limit position.<br>• As this signal turns off, positioning stops. |
| Lower limit signal (RLS) | | 6 | • This signal is input from the limit switch placed at stroke lower limit position.<br>• As this signal turns off, positioning stops. |
| Near-point dog signal (DOG) | | 1 | • This signal is used for detection on the near-point dog during OPR.<br>• As the near-point dog turns on, this signal is detected. |
| Stop signal (STOP) | | 9 | • Input this signal to stop positioning.<br>• As this signal is turned on, the QD73A1 cancels the positioning in execution. Once this signal was turned on, the operation does not restart even if this signal is turned off. |
| Speed-position switching command signal (CHANGE) | | 8 | Input this signal to switch control during the speed-position control switch mode. |
| Power supply (5 to 24V) | | 5 | This power supply is common to the following signals.<br>• Upper limit signal (FLS)<br>• Lower limit signal (RLS)<br>• Near-point dog signal (DOG)<br>• Stop signal (STOP)<br>• Speed-position switching command signal (CHANGE) |

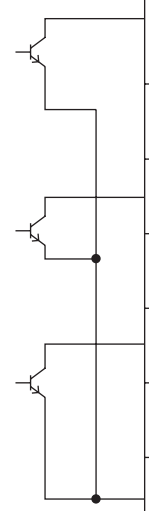
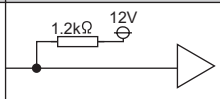
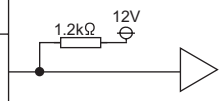
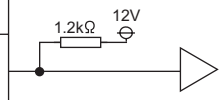
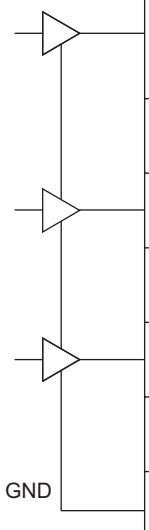
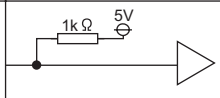
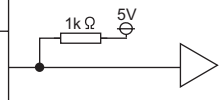
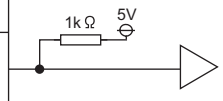
| Signal name | Connector name | Pin number | Signal detail |
|---|---|---|---|
| Servo READY signal (READY) (+ side) | SERVO | 1 | • This signal turns on when the drive unit is ready to operate.<br>• Positioning cannot be started when this signal is off.<br>• If this signal turns off during positioning, the system stops. The system does not operate even if this signal is turned on again. |
| Servo READY signal (READY) (- side) | | 2 | This line is common to Servo READY signal (READY). |
| Servo ON signal (SVON) (+ side) | | 3 | • Wire this signal without fail to prevent malfunction of the servomotor.<br>• This signal turns on automatically if there is no hardware error at a system startup.<br>• This signal turns off if an error was detected due to an excessive error or by the QD73A1's self-diagnosis on its hardware. |
| Servo ON signal (SVON) (- side) | | 4 | This line is common to Servo ON signal (SVON). |
| Speed command signal (+ side) | | 15 | The analog voltage converted from digital accumulated pulse amount is output. |
| Speed command signal (- side) | | 14 | This line is common to Speed command signal. |

# 3.5.4 I/O interface internal circuit

This section shows internal circuits of external device interfaces on the QD73A1 in schematic diagrams.

| External wiring | Pin No. | Internal circuit | Signal name | Remark |
|---|---|---|---|---|
|  | 5 | | Power supply | Input a voltage of 5 to 24VDC. |
| | 1 |  | Near-point dog signal (DOG) | - |
| | 9 | | Stop signal (STOP) | - |
| | 7 | | Upper limit signal (FLS) | If not using these signals, keep them on. |
| | 6 | | Lower limit signal (RLS) | |
| | 8 | | Speed-position switching command signal (CHANGE) | - |
|  | 1 |  | Servo READY signal (READY) | - |
| | 2 | | | |
|  | 3 |  | Servo ON signal (SVON) | - |
| | 4 | | | |
|  | 15 |  | Speed command signal | - |
| | 14 | | | |
|  | 13 |  | Phase-A feedback pulse | [For differential input]<br>Connect these terminals to the terminal/ connector for pulse output of an encoder. |
| | 11 | | | |
|  | 5 |  | Phase-B feedback pulse | |
| | 10 | | | |
|  | 6 |  | Phase-Z feedback pulse | |
| | 7 | | | |
| | 9 | | Analog GND | |

*1 When input impedance of the servo amplifier is low, analog output level may become low due to this resistance. If that causes a problem, perform gain adjustment again with the servo amplifier being connected.

| External wiring | Pin No. | Internal circuit | Signal name | Remark |
|---|---|---|---|---|
|  | 13 |  | Phase-A feedback pulse | [For open collector input]<br>Connect these terminals to the terminal/ connector for pulse output of an encoder.<br>Output is pulled up to 12V inside. |
| | 11 | | | |
| | 5 |  | Phase-B feedback pulse | |
| | 10 | | | |
| | 6 |  | Phase-Z feedback pulse | |
| | 7 | | | |
| | 9 | | Analog GND | |
|  | 13 |  | Phase-A feedback pulse | [For TTL input]<br>Connect these terminals to the terminal/ connector for pulse output of an encoder. |
| | 11 | | | |
| | 5 |  | Phase-B feedback pulse | |
| | 10 | | | |
| | 6 |  | Phase-Z feedback pulse | |
| | 7 | | | |
| GND | 9 | | Analog GND | |

# 3.6 Memory Configuration and Use

There are two memories in the QD73A1.

○: Data setting and storage, —: No data setting and storage

| Memory configuration | Use | Area configuration | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Parameter area | Monitor data area | Control data area | Positioning data area | Zero/gain adjustment data area | Reference value storage area for accumulated pulse error detection function | Backup |
| Buffer memory | Area that can be accessed directly from the CPU module using sequence programs | ○ | ○ | ○ | ○ | — | — | Data in this memory cannot be backed up. Data are erased if the power is turned off. |
| Flash ROM | Area used to back up zero/gain adjustment data | — | — | — | — | ○ | ○ | Data in this memory can be backed up. Data are kept even if the power is turned off. |

The following table describes each memory area.

| Area name | Description | Reference |
|---|---|---|
| Parameter area | Area used to set and store parameters for positioning, such as positioning parameters and OPR parameters | Page 76, Section 5.2<br>Page 80, Section 5.3 |
| Monitor data area | Area where operating statuses of a positioning system are stored | Page 86, Section 5.5 |
| Control data area | Area used to set and store data to operate or control a positioning system | Page 90, Section 5.6 |
| Positioning data area | Area used to set and store positioning data | Page 83, Section 5.4 |
| Zero/gain adjustment data area | Area used to set and store data for zero adjustment and gain adjustment | – |
| Reference value storage area for accumulated pulse error detection function | Area used to store the reference value for the accumulated pulse error detection function | – |

# 3.7 List of Buffer Memory Addresses

This section lists the buffer memory addresses of the QD73A1.

For details on the buffer memory, refer to the following.

☞Page 74, CHAPTER 5

**Point**

Do not write data to system areas and area where data cannot be written from sequence programs in the buffer memory. Writing data to these areas may cause malfunction.

| Address (decimal) | Address (hexadecimal) | Data type*1 | Name | Default value *2 | Read/ Write *3 | Memory area *4 | Reference |
|---|---|---|---|---|---|---|---|
| 0 | $0_H$ | Positioning parameter (fixed parameter) | Pr.1 Stroke limit upper limit | 2147483647 | R/W | Parameter area | Page 77, Section 5.2 (1) |
| 1 | $1_H$ | | | | | | |
| 2 | $2_H$ | | Pr.2 Stroke limit lower limit | 0 | R/W | | |
| 3 | $3_H$ | | | | | | |
| 4 | $4_H$ | | Pr.3 Numerator of command pulse multiplication for electronic gear | 1 | R/W | | Page 78, Section 5.2 (2) |
| 5 | $5_H$ | | Pr.4 Denominator of command pulse multiplication for electronic gear | 1 | R/W | | |
| 6 ⋮ 19 | $6_H$ ⋮ $13_H$ | — | System area | — | — | — | — |
| 20 | $14_H$ | Positioning parameter (variable parameter) | Pr.5 Speed limit value | 200000 | R/W | Parameter area | Page 78, Section 5.2 (3) |
| 21 | $15_H$ | | | | | | |
| 22 | $16_H$ | | Pr.6 Acceleration time | 300 | R/W | | Page 79, Section 5.2 (4) |
| 23 | $17_H$ | | Pr.7 Deceleration time | 300 | R/W | | |
| 24 | $18_H$ | | Pr.8 In-position range | 5 | R/W | | Page 79, Section 5.2 (5) |
| 25 | $19_H$ | | Pr.9 Positioning mode | 0 | R/W | | Page 79, Section 5.2 (6) |
| 26 ⋮ 39 | $1A_H$ ⋮ $27_H$ | — | System area | — | — | — | — |

| Address (decimal) | Address (hexadecimal) | Data type*1 | Name | Default value *2 | Read/ Write *3 | Memory area *4 | Reference |
|---|---|---|---|---|---|---|---|
| 40 | $28_H$ | OPR parameter | Pr.10 OP address | 0 | R/W | Parameter area | Page 80, Section 5.3 (1) |
| 41 | $29_H$ | | | | | | |
| 42 | $2A_H$ | | Pr.11 OPR speed | 10000 | R/W | | Page 80, Section 5.3 (2) |
| 43 | $2B_H$ | | | | | | |
| 44 | $2C_H$ | | Pr.12 Creep speed | 1000 | R/W | | Page 81, Section 5.3 (3) |
| 45 | $2D_H$ | | | | | | |
| 46 | $2E_H$ | | Pr.13 Setting for the movement amount after near-point dog ON | 75 | R/W | | Page 82, Section 5.3 (4) |
| 47 | $2F_H$ | | | | | | |
| 48 ⋮ 79 | $30_H$ ⋮ $4F_H$ | — | System area | — | — | — | — |
| 80 | $50_H$ | Control data (control change area) | Cd.1 New current value | 0 | R/W | Control data area | Page 90, Section 5.6 |
| 81 | $51_H$ | | | 0 | | | |
| 82 | $52_H$ | | Cd.2 New speed value | 0 | R/W | | |
| 83 | $53_H$ | | | 0 | | | |
| 84 | $54_H$ | | Cd.3 JOG speed | 0 | R/W | | |
| 85 | $55_H$ | | | 0 | | | |
| 86 | $56_H$ | | Cd.4 Deviation counter clear command | 0 | R/W | | |
| 87 | $57_H$ | | Cd.5 Analog output adjustment area 1 | 0 | R/W | | |
| 88 | $58_H$ | | Cd.6 New speed-position movement amount | 0 | R/W | | |
| 89 | $59_H$ | | | 0 | | | |
| 90 | $5A_H$ | | Cd.7 Current value change request | 0 | R/W | | |
| 91 | $5B_H$ | | Cd.8 Speed change request | 0 | R/W | | |
| 92 | $5C_H$ | | Cd.9 Analog output adjustment area 2 | 0 | R/W | | |
| 93 | $5D_H$ | | | 0 | | | |
| 94 | $5E_H$ | control data (zero/gain adjustment area) | Cd.10 Zero/gain adjustment specification | 0 | R/W | | |
| 95 | $5F_H$ | | Cd.11 Zero/gain adjustment value specification | 0 | R/W | | |
| 96 | $60_H$ | | Cd.12 Factory default zero/gain adjustment value restoration request | 0 | R/W | | |
| 97 ⋮ 99 | $61_H$ ⋮ $63_H$ | — | System area | — | — | — | — |

| Address (decimal) | Address (hexadecimal) | Data type*1 | Name | | Default value *2 | Read/ Write *3 | Memory area *4 | Reference |
|---|---|---|---|---|---|---|---|---|
| 100 | $64_H$ | Monitor data (monitor area) | Md.1 Current feed value | | 0 | R | Monitor data area | Page 86, Section 5.5 |
| 101 | $65_H$ | | | | | | | |
| 102 | $66_H$ | | Md.2 Actual current value | | 0 | R | | |
| 103 | $67_H$ | | | | | | | |
| 104 | $68_H$ | | Md.3 Error code (ERR.1) | | 0 | R | | |
| 105 | $69_H$ | | Md.4 Error code (ERR.2) | | 0 | R | | |
| 106 | $6A_H$ | | Md.5 Deviation counter value | | 0 | R | | |
| 107 | $6B_H$ | | | | | | | |
| 108 | $6C_H$ | | Md.6 Movement amount after near-point dog ON | | 0 | R | | |
| 109 | $6D_H$ | | | | | | | |
| 110 | $6E_H$ | | Md.7 Speed-position switching command | | 0 | R | | |
| 111 | $6F_H$ | | Md.8 Control mode | | 0 | R | | |
| 112 | $70_H$ | | Md.9 Zero/gain execution status | | 0 | R | | |
| 113 | $71_H$ | | Md.10 Zero/gain adjustment status | | 0 | R | | |
| 114 | $72_H$ | | Md.11 Feedrate | | 0 | R | | |
| 115 | $73_H$ | | | | | | | |
| 116 ⋮ 119 | $74_H$ ⋮ $77_H$ | — | System area | | — | — | — | — |
| 120 | $78_H$ | Monitor data (monitor area) | Record 0 | Md.12 Error code | 0 | R | Monitor data area | Page 86, Section 5.5 |
| 121 | $79_H$ | | | Md.13 Error occurrence (Year: Month) | $0000_H$ | | | |
| 122 | $7A_H$ | | | Md.14 Error occurrence (Day: Hour) | $0000_H$ | | | |
| 123 | $7B_H$ | | | Md.15 Error occurrence (Minute: Second) | $0000_H$ | | | |
| 124 | $7C_H$ | | Record 1 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 125 | $7D_H$ | | | | | | | |
| 126 | $7E_H$ | | | | | | | |
| 127 | $7F_H$ | | | | | | | |
| 128 | $80_H$ | | Record 2 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 129 | $81_H$ | | | | | | | |
| 130 | $82_H$ | | | | | | | |
| 131 | $83_H$ | | | | | | | |

| Address (decimal) | Address (hexadecimal) | Data type*1 | Name | | Default value *2 | Read/ Write *3 | Memory area *4 | Reference |
|---|---|---|---|---|---|---|---|---|
| 132 | $84_H$ | Monitor data (monitor area) | Record 3 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | Monitor data area | Page 86, Section 5.5 |
| 133 | $85_H$ | | | | | | | |
| 134 | $86_H$ | | | | | | | |
| 135 | $87_H$ | | | | | | | |
| 136 | $88_H$ | | Record 4 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 137 | $89_H$ | | | | | | | |
| 138 | $8A_H$ | | | | | | | |
| 139 | $8B_H$ | | | | | | | |
| 140 | $8C_H$ | | Record 5 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 141 | $8D_H$ | | | | | | | |
| 142 | $8E_H$ | | | | | | | |
| 143 | $8F_H$ | | | | | | | |
| 144 | $90_H$ | | Record 6 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 145 | $91_H$ | | | | | | | |
| 146 | $92_H$ | | | | | | | |
| 147 | $93_H$ | | | | | | | |
| 148 | $94_H$ | | Record 7 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 149 | $95_H$ | | | | | | | |
| 150 | $96_H$ | | | | | | | |
| 151 | $97_H$ | | | | | | | |
| 152 | $98_H$ | | Record 8 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 153 | $99_H$ | | | | | | | |
| 154 | $9A_H$ | | | | | | | |
| 155 | $9B_H$ | | | | | | | |
| 156 | $9C_H$ | | Record 9 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 157 | $9D_H$ | | | | | | | |
| 158 | $9E_H$ | | | | | | | |
| 159 | $9F_H$ | | | | | | | |
| 160 | $A0_H$ | | Record 10 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 161 | $A1_H$ | | | | | | | |
| 162 | $A2_H$ | | | | | | | |
| 163 | $A3_H$ | | | | | | | |

| Address (decimal) | Address (hexadecimal) | Data type*1 | Name | | Default value *2 | Read/ Write *3 | Memory area *4 | Reference |
|---|---|---|---|---|---|---|---|---|
| 164 | $A4_H$ | Monitor data (monitor area) | Record 11 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | Monitor data area | Page 86, Section 5.5 |
| 165 | $A5_H$ | | | | | | | |
| 166 | $A6_H$ | | | | | | | |
| 167 | $A7_H$ | | | | | | | |
| 168 | $A8_H$ | | Record 12 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 169 | $A9_H$ | | | | | | | |
| 170 | $AA_H$ | | | | | | | |
| 171 | $AB_H$ | | | | | | | |
| 172 | $AC_H$ | | Record 13 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 173 | $AD_H$ | | | | | | | |
| 174 | $AE_H$ | | | | | | | |
| 175 | $AF_H$ | | | | | | | |
| 176 | $B0_H$ | | Record 14 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 177 | $B1_H$ | | | | | | | |
| 178 | $B2_H$ | | | | | | | |
| 179 | $B3_H$ | | | | | | | |
| 180 | $B4_H$ | | Record 15 | Error code and error occurrence (The same data structure as record 0) | Same as record 0 | R | | |
| 181 | $B5_H$ | | | | | | | |
| 182 | $B6_H$ | | | | | | | |
| 183 | $B7_H$ | | | | | | | |
| 184 | $B8_H$ | | Md.16 Error history pointer | | 0 | R | | |
| 185 ⋮ 199 | $B9_H$ ⋮ $C7_H$ | — | System area | | — | — | — | — |
| 200 | $C8_H$ | Monitor data (monitor area) | Md.17 Maximum accumulated pulse value | | 0 | R | Monitor data area | Page 86, Section 5.5 |
| 201 | $C9_H$ | | | | | | | |
| 202 | $CA_H$ | | Md.18 Minimum accumulated pulse value | | 0 | R | | |
| 203 | $CB_H$ | | | | | | | |
| 204 | $CC_H$ | | Md.19 Accumulated pulse error detection function status | | 0 | R | | |
| 205 | $CD_H$ | | Md.20 Reference value measurement flag | | 0 | R | | |
| 206 ⋮ 300 | $CE_H$ ⋮ $12C_H$ | — | System area | | — | — | — | — |

| Address (decimal) | Address (hexadecimal) | Data type*1 | Name | Default value *2 | Read/ Write *3 | Memory area *4 | Reference |
|---|---|---|---|---|---|---|---|
| 301 | $12D_H$ | Positioning data | Da.1 Positioning pattern | 0 | R/W | Positioning data area | Page 83, Section 5.4 (1) |
| 302 | $12E_H$ | | Da.2 Positioning address P1 | 0 | R/W | | Page 84, Section 5.4 (2) |
| 303 | $12F_H$ | | | | | | |
| 304 | $130_H$ | | Da.3 Positioning speed V1 | 0 | R/W | | Page 85, Section 5.4 (3) |
| 305 | $131_H$ | | | | | | |
| 306 | $132_H$ | | Da.4 Positioning address P2 | 0 | R/W | | Page 85, Section 5.4 (4) |
| 307 | $133_H$ | | | | | | |
| 308 | $134_H$ | | Da.5 Positioning speed V2 | 0 | R/W | | Page 85, Section 5.4 (5) |
| 309 | $135_H$ | | | | | | |
| 310 ⋮ 399 | $136_H$ ⋮ $18F_H$ | — | System area | — | — | — | — |
| 400 | $190_H$ | Control data | Cd.13 Alert output accumulated pulse setting value (maximum value) | 0 | R/W | Control data area | Page 90, Section 5.6 |
| 401 | $191_H$ | | | | | | |
| 402 | $192_H$ | | Cd.14 Immediate stop accumulated pulse setting value (maximum value) | 0 | R/W | | |
| 403 | $193_H$ | | | | | | |
| 404 | $194_H$ | | Cd.15 Alert output accumulated pulse setting value (minimum value) | 0 | R/W | | |
| 405 | $195_H$ | | | | | | |
| 406 | $196_H$ | | Cd.16 Immediate stop accumulated pulse setting value (minimum value) | 0 | R/W | | |
| 407 | $197_H$ | | | | | | |
| 408 | $198_H$ | | Cd.17 Accumulated pulse setting value selection | 0 | R/W | | |
| 409 | $199_H$ | | Cd.18 Accumulated pulse error detection request | 0 | R/W | | |
| 410 | $19A_H$ | | Cd.19 Measurement start request | 0 | R/W | | |
| 411 | $19B_H$ | | Cd.20 Reference value write request | 0 | R/W | | |
| 412 ⋮ 1001 | $19C_H$ ⋮ $3E9_H$ | — | System area | — | — | — | — |

*1 For types of data, refer to the following.
☞ Page 74, Section 5.1

*2 Default values are set after the power was turned off and on or the CPU module was reset.

*3 This column indicates whether the data can be read from or written to the buffer memory area through sequence programs.
R: Readable
W: Writable

*4 For the memory configuration, refer to the following.
☞ Page 48, Section 3.6

# CHAPTER 4 SETTINGS AND PROCEDURE BEFORE OPERATION

This chapter describes the procedure prior to operation, part names, zero/gain adjustment, and wiring method of the QD73A1.



## 4.1 Handling Precautions

This section describes the handling precautions for the QD73A1.

- Do not disassemble the module. Doing so may cause failure, malfunction, injury, or a fire.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit may cause malfunction.
- Use the programmable controller in an environment that meets the general specifications in the user's manual for the CPU module used. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection(s) into the hole(s) in the base unit and press the module until it snaps into place. Incorrect mounting may cause malfunction, failure or drop of the module. When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the screws such as a module fixing screw within the specified torque range. Undertightening can cause drop of the screw, short circuit or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.

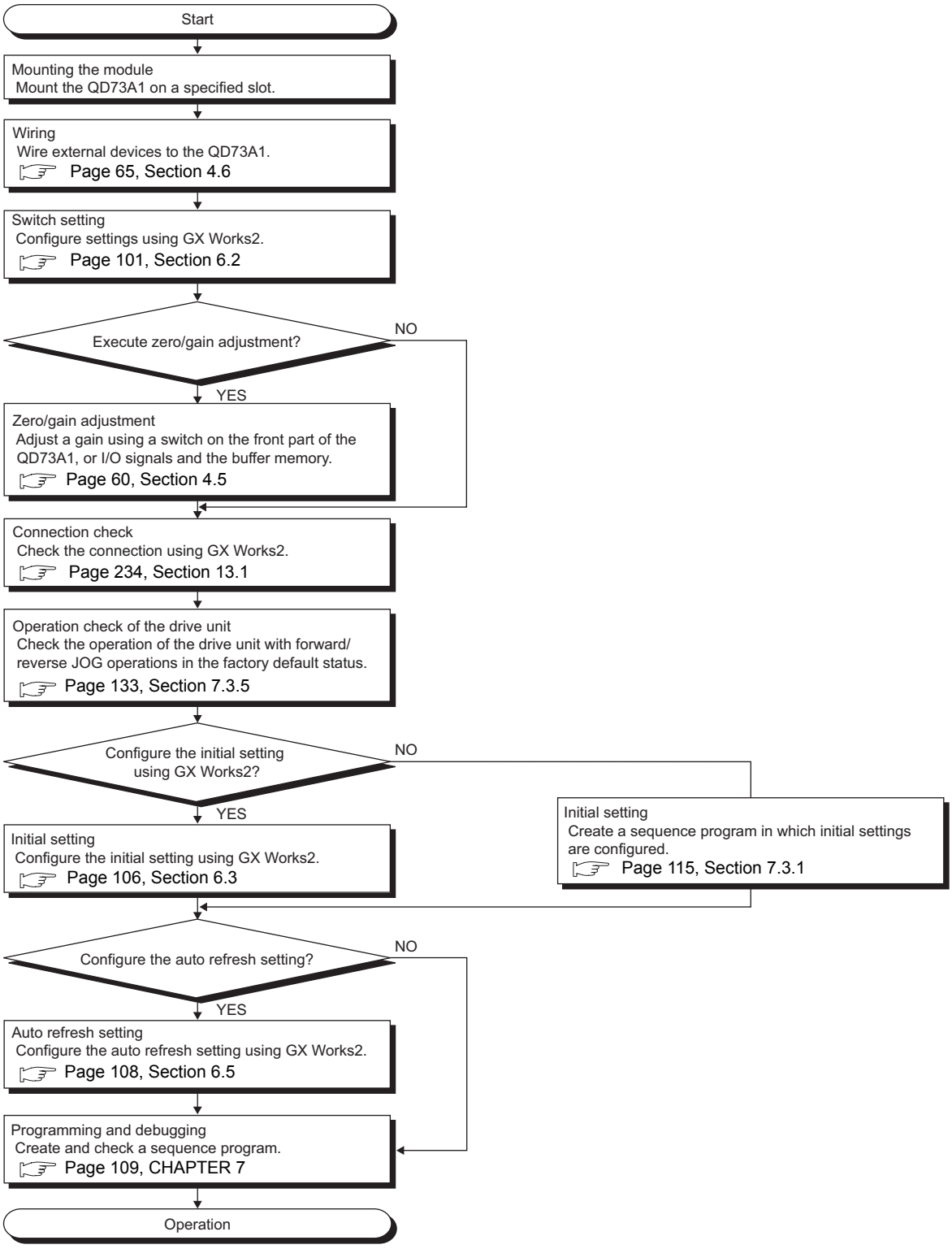
| Screw | Tightening torque range |
|---|---|
| Module fixing screw (M3 screw)*1 | 0.36 to 0.48N • m |
| Connector screw (M2.6 screw) | 0.20 to 0.29N • m |

*1 The module can be easily fixed onto the base unit using the hook at the top of the module. However, it is recommended to secure the module with the module fixing screw if the module is subject to significant vibration.

- Do not directly touch any conductive parts and electronic components of the module. Doing so can cause malfunction or failure of the module.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- Do not drop the module case, or do not subject it to strong impact.
- Lock the control panel so that only specialists educated in electric installation can open it.

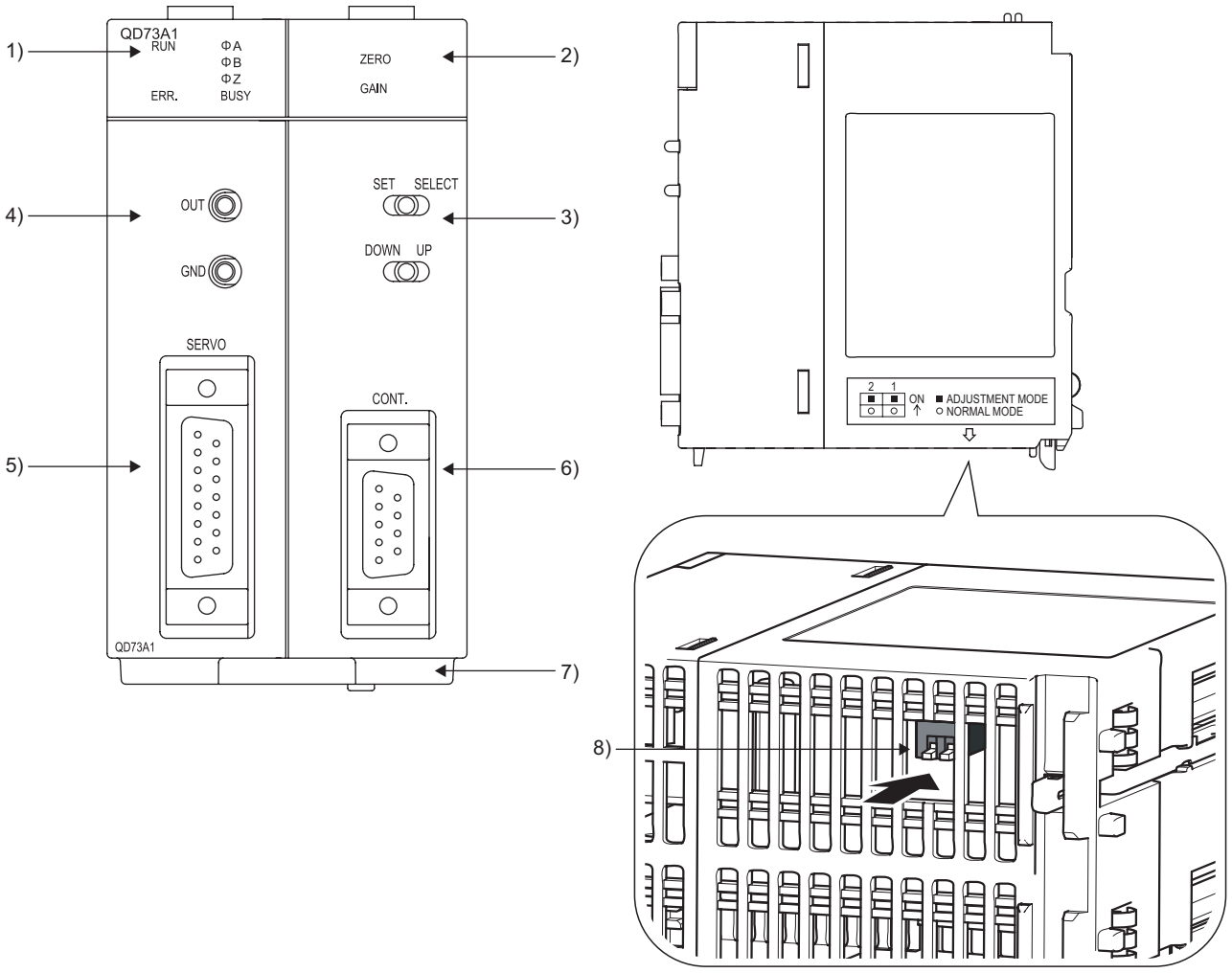
# 4.2 Settings and Procedure Before Operation

This section shows the procedure before operating the QD73A1.


Start
Mounting the module
Mount the QD73A1 on a specified slot.
Wiring
Wire external devices to the QD73A1.
Page 65, Section 4.6
Switch setting
Configure settings using GX Works2.
Page 101, Section 6.2
Execute zero/gain adjustment?
NO
YES
Zero/gain adjustment
Adjust a gain using a switch on the front part of the QD73A1, or I/O signals and the buffer memory.
Page 60, Section 4.5
Connection check
Check the connection using GX Works2.
Page 234, Section 13.1
Operation check of the drive unit
Check the operation of the drive unit with forward/reverse JOG operations in the factory default status.
Page 133, Section 7.3.5
Configure the initial setting using GX Works2?
NO
YES
Initial setting
Create a sequence program in which initial settings are configured.
Page 115, Section 7.3.1
Initial setting
Configure the initial setting using GX Works2.
Page 106, Section 6.3
Configure the auto refresh setting?
NO
YES
Auto refresh setting
Configure the auto refresh setting using GX Works2.
Page 108, Section 6.5
Programming and debugging
Create and check a sequence program.
Page 109, CHAPTER 7
Operation

# 4.3 Part Names

This section describes the part names of the QD73A1.

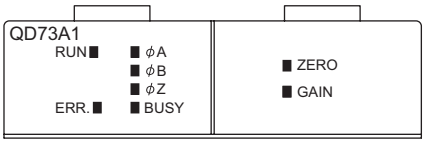



| Number | Name | Description | Reference |
|---|---|---|---|
| 1) | RUN LED | Indicates the operating status or error status of the QD73A1 | Page 59, Section 4.4 |
| | ERR. LED | | |
| | ϕ A LED<br>ϕ B LED<br>ϕ Z LED | Indicates the status of pulses on an encoder input phase A, B, or Z | |
| | BUSY LED | Indicates the status of BUSY signal (X14) or writing of zero adjustment value and gain adjustment value | |
| 2) | ZERO LED<br>GAIN LED | Indicates the status of zero/gain adjustment | |
| 3) | SELECT/SET switch | A switch for zero adjustment and gain adjustment | Page 62, Section 4.5 (4) |
| | UP/DOWN switch | A switch to adjust an analog output voltage value | |
| 4) | OUT terminal<br>GND terminal | Check pins to measure analog output voltage<br>(Use these pins for zero/gain adjustment.)<br>[Inside diameter]<br>2.03mm for both OUT terminal and GND terminal | Page 60, Section 4.5 |

| Number | Name | Description | Reference |
|---|---|---|---|
| 5) | SERVO connector | A connector for a drive unit | Page 44, Section 3.5.3<br>Page 70, Section 4.6.3 |
| 6) | CONT. connector | A connector for external control devices | |
| 7) | Serial number display | Displays the serial number of the QD73A1 | — |
| 8) | Mode switch | A switch to change the operation mode to the zero/gain adjustment mode. (DIP switch 1 and 2 are off as the factory default.) | Page 62, Section 4.5 (4) (a) |

# 4.4 LED

The LEDs on the front of the QD73A1 indicate the statuses of the module and axis control.




| Indication<br>□: OFF<br>■: ON<br>◆: Flashing | Attention | Description |
|---|---|---|
| RUN □ □ φA □ ZERO<br>□ φB □ GAIN<br>□ φZ<br>ERR. □ □ BUSY | RUN LED: OFF<br>(All the other LEDs are OFF or ON.) | • The power is off.<br>• A hardware error is occurring.<br>• A watchdog timer error is occurring.<br>If the RUN LED does not turn on even after the power was turned off and on, the module may be broken. Replace the module with another module. |
| RUN ■ □ φA □ ZERO<br>□ φB □ GAIN<br>□ φZ<br>ERR. □ □ BUSY | • RUN LED: ON<br>• ERR. LED: OFF | The module is operating normally. |
| RUN ■ □ φA □ ZERO<br>□ φB □ GAIN<br>□ φZ<br>ERR. ■ □ BUSY | ERR. LED: ON<br>(All the other LEDs are OFF or ON.) | An error is occurring.<br>Read out the error code, and take the corrective action described in the error code list. (☞ Page 250, Section 14.3.4) |
| RUN ■ □ φA □ ZERO<br>□ φB □ GAIN<br>□ φZ<br>ERR. □ ■ BUSY | BUSY LED: ON<br>(All the other LEDs are OFF or ON.) | Positioning is in execution.<br>The LED turns off when the positioning is completed. |
| RUN ■ ■ φA □ ZERO<br>■ φB □ GAIN<br>■ φZ<br>ERR. □ □ BUSY | • φ A LED: ON or flashing<br>• φ B LED: ON or flashing<br>• φ Z LED: ON or flashing | Pulses are input through the pulse input terminals (phase A, B, and Z). |
| RUN ◆ □ φA ■ ZERO<br>□ φB □ GAIN<br>□ φZ<br>ERR. □ □ BUSY | • RUN LED: Flashing<br>• ZERO LED: ON | Zero adjustment of analog output is being performed.<br>The LED turns off when the zero adjustment is completed. |
| RUN ◆ □ φA □ ZERO<br>□ φB ■ GAIN<br>□ φZ<br>ERR. □ □ BUSY | • RUN LED: Flashing<br>• GAIN LED: ON | Gain adjustment of analog output is being performed.<br>The LED turns off when the gain adjustment is completed. |
| RUN ◆ □ φA □ ZERO<br>□ φB □ GAIN<br>□ φZ<br>ERR. □ ■ BUSY | • RUN LED: Flashing<br>• BUSY LED: ON<br>(The ZERO LED is ON during zero adjustment. The GAIN LED is ON during gain adjustment.) | The zero adjustment value and the gain adjustment value are being written.<br>The LED turns off when writing of the zero adjustment value and gain adjustment value is completed. |

# 4.5 Zero/gain Adjustment

Zero/gain adjustment is a process to adjust analog output voltage according to accumulated pulse amount.
Adjust the analog output voltage value according to the analog speed command input of the drive unit used.
Adjust analog output voltage using the check pins on the front of the QD73A1.
For the position of check pins, refer to the following.

☞Page 57, Section 4.3

## (1) Zero adjustment

Adjust the analog output voltage of when accumulated pulse amount is "0". The voltage is adjusted to 0V as the factory default. Zero adjustment may vary when the module is connected to a servomotor. In that case, perform zero adjustment again. If the module is used with its zero adjustment being off, the connected servomotor rotates a little when the power is turned on.

## (2) Gain adjustment

Adjust the analog output voltage of when accumulated pulse amount is the maximum.
When "Accumulated pulse setting" in the switch setting is set to the default (0) and the command voltage is 10V, set accumulated pulse amount of -14800 to -13000 or 13000 to 14800 as a reference as in the following table. In this case, the default accumulated pulse amount becomes 13920 pulses. In the factory default setting, adjustment is made so that the gain value becomes 10V when accumulated pulse amount is 13920 pulses (default value). If "Accumulated pulse setting" was changed from its default, perform gain adjustment again.

| "Accumulated pulse setting"*1 | Accumulated pulse amount (unit: pulse) | | | Excessive error (unit: pulse) |
|---|---|---|---|---|
| | A setting range reference when the gain value is 5V | A setting range reference when the gain value is 10V | Default value | |
| Not set | Same as the case in which "-14800 to 14800" [selection 4] is selected. | | | |
| -3700 to 3700<br>[selection 1] | -2500 to -2000<br>2000 to 2500 | -3700 to -3250<br>3250 to 3700 | 3480 | 3701 or more |
| -7400 to 7400<br>[selection 2] | -5000 to -4000<br>4000 to 5000 | -7400 to -6500<br>6500 to 7400 | 6960 | 7401 or more |
| -11100 to 11100<br>[selection 3] | -7500 to -6000<br>6000 to 7500 | -11100 to -9750<br>9750 to 11100 | 10440 | 11101 or more |
| -14800 to 14800<br>[selection 4] | -10000 to -8000<br>8000 to 10000 | -14800 to -13000<br>13000 to 14800 | 13920 | 14801 or more |
| -37000 to 37000<br>[selection 5] | -25000 to -20000<br>20000 to 25000 | -37000 to -32500<br>32500 to 37000 | 34800 | 37001 or more |
| -74000 to 74000<br>[selection 6] | -50000 to -40000<br>40000 to 50000 | -74000 to -65000<br>65000 to 74000 | 69600 | 74001 or more |
| -111000 to 111000<br>[selection 7] | -75000 to -60000<br>60000 to 75000 | -111000 to -97500<br>97500 to 111000 | 104400 | 111001 or more |
| -148000 to 148000<br>[selection 8] | -100000 to -80000<br>80000 to 100000 | -148000 to -130000<br>130000 to 148000 | 139200 | 148001 or more |

*1 If a range other than the selection 1 to 8 is set, the default value (0) is used.

When performing gain adjustment, a gain value can be adjusted within the range of 5 to 10V. Adjust a gain value according to the rated speed command voltage of the servo amplifier to be used.

Gain adjustment can be performed in the following two methods.

- Adjusting with the default accumulated pulse amount
- Adjusting with specified accumulated pulse amount

### (a) Adjusting gain with the default accumulated pulse amount

Follow the procedure below.

| | |
|---|---|
| 1 | Change the operation mode to the zero/gain adjustment mode. |
| 2 | Set "Accumulated pulse setting" in the switch setting according to the necessary accumulated pulse amount. |
| 3 | Adjust the voltage to be the necessary voltage value between the check pins. |

### (b) Adjusting gain with specified accumulated pulse amount

Follow the procedure below.

| | |
|---|---|
| 1 | Change the operation mode to the zero/gain adjustment mode. |
| 2 | Set "Accumulated pulse setting" in the switch setting according to the necessary accumulated pulse amount. (Do not specify amount that exceeds the setting range.) |
| 3 | Write the accumulated pulse amount using a sequence program.<br>[When one of the selections 1 to 4 is specified in "Accumulated pulse setting"]<br>Set the specified accumulated pulse amount in " Cd.5 Analog output adjustment area 1".<br> <br><br>[When one of the selections 5 to 8 is specified in "Accumulated pulse setting"]<br>Set the specified accumulated pulse amount in " Cd.9 Analog output adjustment area 2".<br> <br> |
| 4 | Adjust the voltage to be the necessary voltage value between the check pins. |

## (3) Zero/gain adjustment setting range

When performing zero/gain adjustment, satisfy the following two conditions.

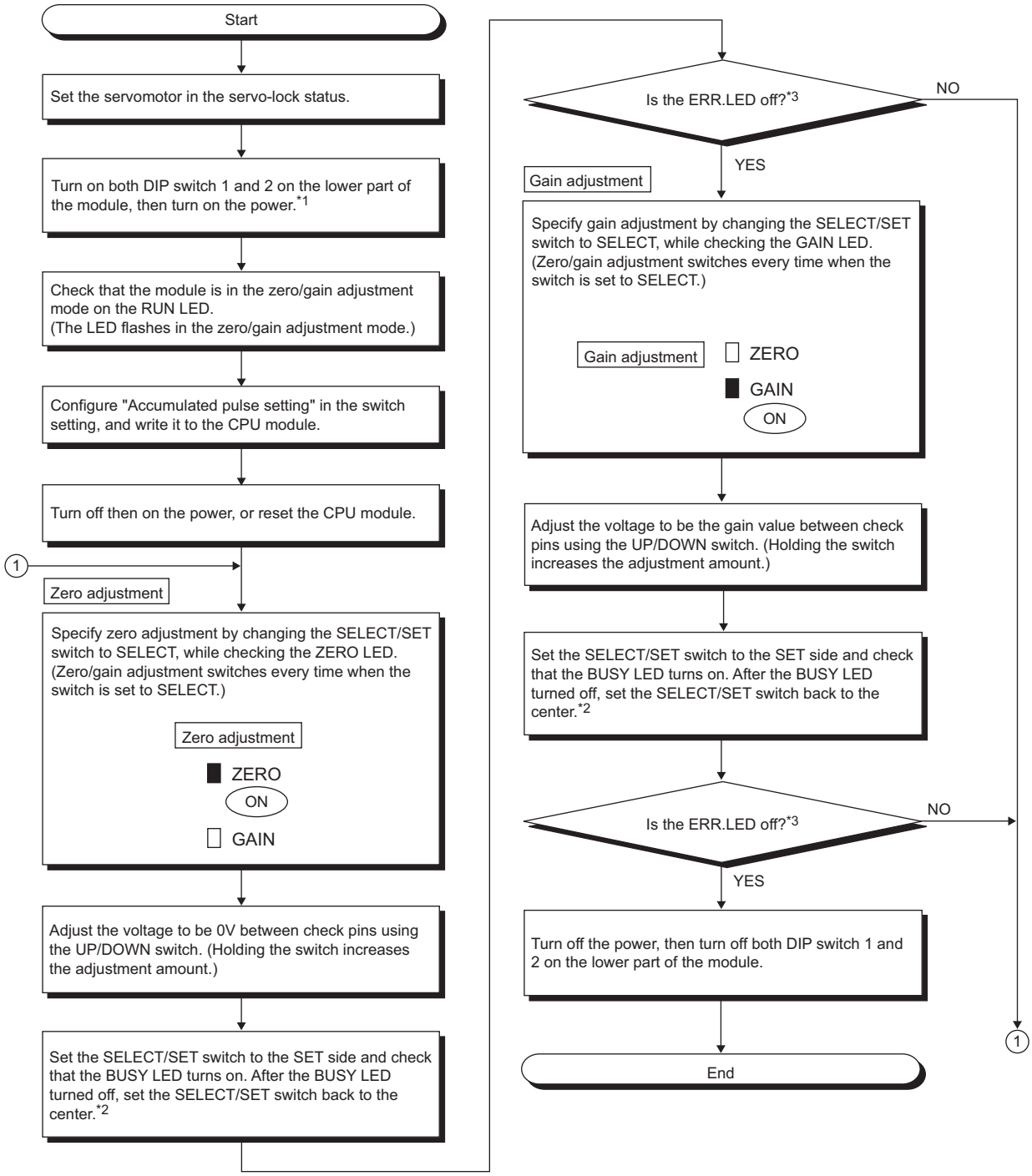
- Setting range: -10 to 10V
- The difference between a gain value and zero value is as follows.

| | |
|---|---|
| In case of positive accumulated pulse amount | (Gain value) - (Zero value) ≥ 5.0V |
| In case of negative accumulated pulse amount | (Gain value) - (Zero value) ≤ -5.0V |

## (4) Setting method

The following are the procedures for zero adjustment and gain adjustment.

### (a) When using the switches on the front of the QD73A1

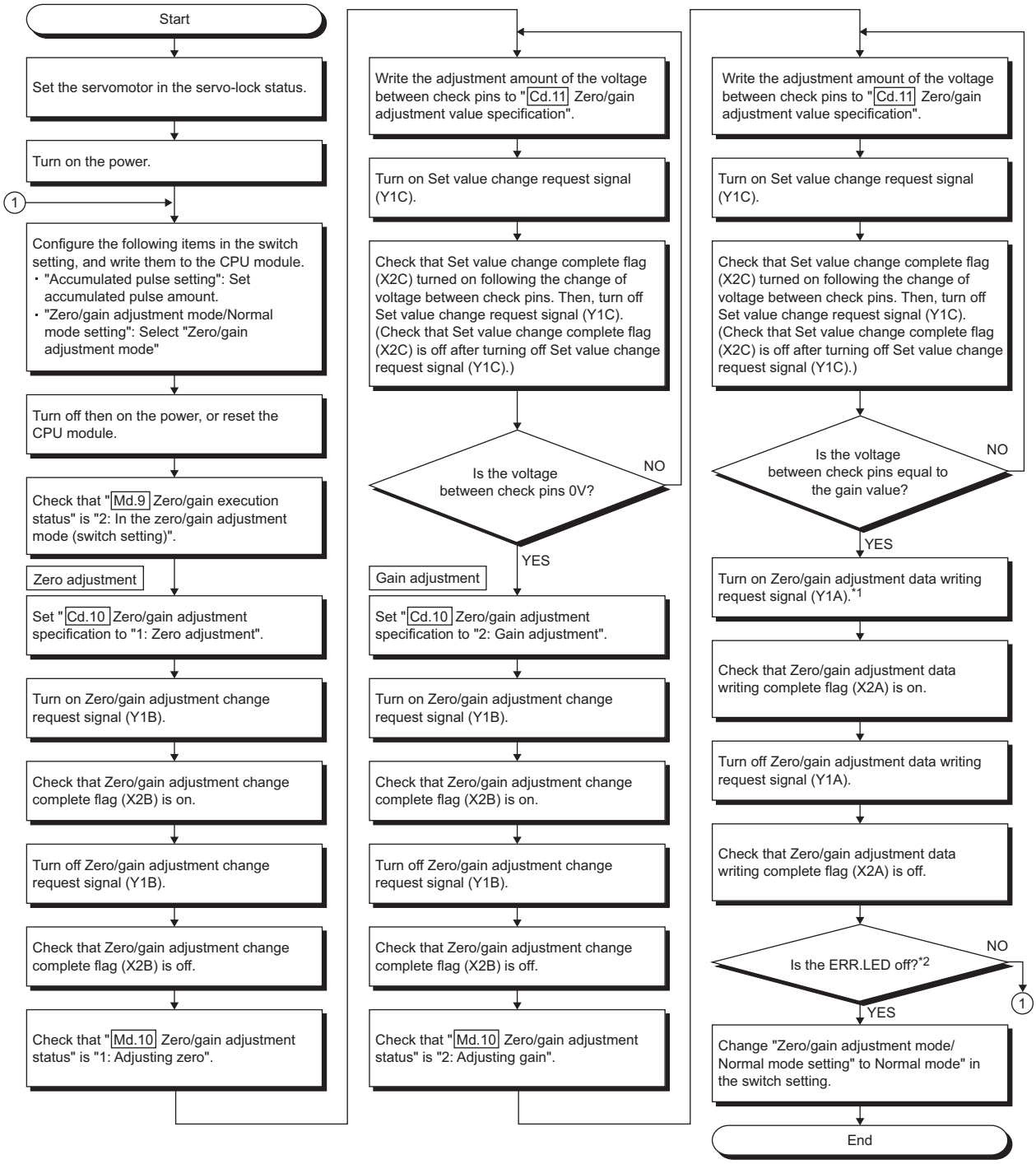

Start
Set the servomotor in the servo-lock status.
Turn on both DIP switch 1 and 2 on the lower part of the module, then turn on the power.*1
Check that the module is in the zero/gain adjustment mode on the RUN LED.
(The LED flashes in the zero/gain adjustment mode.)
Configure "Accumulated pulse setting" in the switch setting, and write it to the CPU module.
Turn off then on the power, or reset the CPU module.
1
Zero adjustment
Specify zero adjustment by changing the SELECT/SET switch to SELECT, while checking the ZERO LED.
(Zero/gain adjustment switches every time when the switch is set to SELECT.)
Zero adjustment
ZERO
ON
GAIN
Adjust the voltage to be 0V between check pins using the UP/DOWN switch. (Holding the switch increases the adjustment amount.)
Set the SELECT/SET switch to the SET side and check that the BUSY LED turns on. After the BUSY LED turned off, set the SELECT/SET switch back to the center.*2
Is the ERR.LED off?*3
NO
YES
Gain adjustment
Specify gain adjustment by changing the SELECT/SET switch to SELECT, while checking the GAIN LED.
(Zero/gain adjustment switches every time when the switch is set to SELECT.)
Gain adjustment
ZERO
GAIN
ON
Adjust the voltage to be the gain value between check pins using the UP/DOWN switch. (Holding the switch increases the adjustment amount.)
Set the SELECT/SET switch to the SET side and check that the BUSY LED turns on. After the BUSY LED turned off, set the SELECT/SET switch back to the center.*2
Is the ERR.LED off?*3
NO
YES
Turn off the power, then turn off both DIP switch 1 and 2 on the lower part of the module.
End
1

*1 The operation mode cannot be switched to the zero/gain adjustment mode if the power is turned on ahead of turning on DIP switch 1 and 2.

*2 The zero adjustment value and gain adjustment value are recorded in the flash ROM inside the QD73A1 by setting the SELECT/SET switch on the SET side, and they are not erased even at a power-off.

*3 If an error occurs in the zero/gain adjustment mode, the ERR. LED turns on. If the ERR. LED is on, turn on Error reset signal (Y28) then perform zero/gain adjustment again.

### (b) When using I/O signals and the buffer memory


Start
Set the servomotor in the servo-lock status.
Turn on the power.
1
Configure the following items in the switch setting, and write them to the CPU module.
・"Accumulated pulse setting": Set accumulated pulse amount.
・"Zero/gain adjustment mode/Normal mode setting": Select "Zero/gain adjustment mode"
Turn off then on the power, or reset the CPU module.
Check that "Md.9 Zero/gain execution status" is "2: In the zero/gain adjustment mode (switch setting)".
Zero adjustment
Set "Cd.10 Zero/gain adjustment specification to "1: Zero adjustment".
Turn on Zero/gain adjustment change request signal (Y1B).
Check that Zero/gain adjustment change complete flag (X2B) is on.
Turn off Zero/gain adjustment change request signal (Y1B).
Check that Zero/gain adjustment change complete flag (X2B) is off.
Check that "Md.10 Zero/gain adjustment status" is "1: Adjusting zero".
Write the adjustment amount of the voltage between check pins to "Cd.11 Zero/gain adjustment value specification".
Turn on Set value change request signal (Y1C).
Check that Set value change complete flag (X2C) turned on following the change of voltage between check pins. Then, turn off Set value change request signal (Y1C). (Check that Set value change complete flag (X2C) is off after turning off Set value change request signal (Y1C).)
Is the voltage between check pins 0V?
NO
YES
Gain adjustment
Set "Cd.10 Zero/gain adjustment specification to "2: Gain adjustment".
Turn on Zero/gain adjustment change request signal (Y1B).
Check that Zero/gain adjustment change complete flag (X2B) is on.
Turn off Zero/gain adjustment change request signal (Y1B).
Check that Zero/gain adjustment change complete flag (X2B) is off.
Check that "Md.10 Zero/gain adjustment status" is "2: Adjusting gain".
Write the adjustment amount of the voltage between check pins to "Cd.11 Zero/gain adjustment value specification".
Turn on Set value change request signal (Y1C).
Check that Set value change complete flag (X2C) turned on following the change of voltage between check pins. Then, turn off Set value change request signal (Y1C). (Check that Set value change complete flag (X2C) is off after turning off Set value change request signal (Y1C).)
Is the voltage between check pins equal to the gain value?
NO
YES
Turn on Zero/gain adjustment data writing request signal (Y1A).*1
Check that Zero/gain adjustment data writing complete flag (X2A) is on.
Turn off Zero/gain adjustment data writing request signal (Y1A).
Check that Zero/gain adjustment data writing complete flag (X2A) is off.
Is the ERR.LED off?*2
NO
1
YES
Change "Zero/gain adjustment mode/ Normal mode setting" to Normal mode" in the switch setting.
End

*1 The zero adjustment value and gain adjustment value are recorded in the flash ROM inside the QD73A1 by turning on Zero/gain adjustment data writing request signal (Y1A), and they are not erased even at a power-off.

*2 If an error occurs in the zero/gain adjustment mode, the ERR. LED turns on. If the ERR. LED is on, turn on Error reset signal (Y28) then perform zero/gain adjustment again.

## (5) Restoring the zero/gain adjustment value of the factory default

Writing "1" in "Cd.12 Factory default zero/gain adjustment value restoration request" restores the zero/gain adjustment value of the factory default. Once the restoration was completed, the QD73A1 sets "0" in "Cd.12 Factory default zero/gain adjustment value restoration request".

Once the restoration was completed, analog output voltage becomes 0V and the QD73A1 sets "1: Adjusting zero" in "Md.10 Zero/gain adjustment status".

Note that "Cd.12 Factory default zero/gain adjustment value restoration request" is usable only in the zero/gain adjustment mode.

| Setting item | | Setting range | Default value | Execution condition | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.12 | Factory default zero/gain adjustment value restoration request | 1: Restore the zero/gain adjustment value | 0 | The module must be in the zero/gain adjustment mode. | 96 |

**Point**

Zero value and gain value of the factory default are set as below.

- Zero value: 0V
- Gain value: 10V

Note that the values above were set when "Accumulated pulse setting" was the default value (-14800 to 14800pulse).

# 4.6 Wiring

This section describes precautions on wiring the QD73A1 and external devices, and connection of external device connectors.

## 4.6.1 Wiring precautions

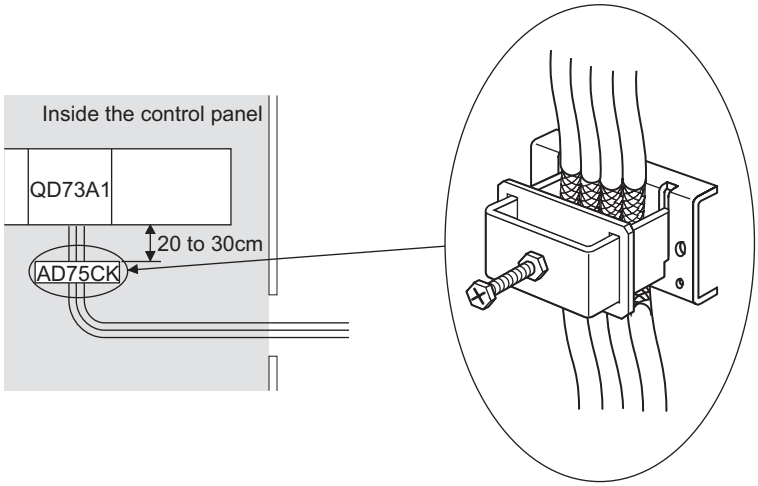
This section describes the precautions on wiring.

- Check the terminal layout beforehand to wire cables to the module correctly.
- Connectors for external devices must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete soldering or crimping may result in malfunction.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring.
  Remove it for heat dissipation before system operation.
- Connect the external device connectors to the connectors on the module and tighten the screws securely.
  Tighten the connector screws within the specified torque range.
  Undertightening can cause short circuit, fire, or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.

| Screw | Tightening torque range |
|---|---|
| Connector screw (M2.6 screw) | 0.20 to 0.29N • m |

- When disconnecting a cable from the module or the drive unit, do not pull the cable by the cable part.
  Disconnect the cable holding the connector.
  Pulling a cable connected to the module or the drive unit can cause malfunction.
  Such action can also damage the module, drive unit, or cable.
- Do not install the connection cables for external I/O signals and for the drive unit together with the main circuit lines, power cables, or load circuit lines of a device other than the programmable controller. Keep a distance of 100mm or more between them.
  Failure to do so may result in malfunction due to noise, surges, and induction.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module, drive unit, or cables, or malfunction due to poor contact.

- As a measure against noise, use shielded cables if the cables connected to the module are close (less than 100mm) to a power cable.
  Ground the shields of shielded cables to the control panel securely on the module side.
- To comply with EMC and Low Voltage Directives, ground shielded cables to the control panel using the AD75CK cable clamp (manufactured by Mitsubishi Electric).
  (Ground the shield parts at a point within 20 to 30cm from the module.)




For details on the AD75CK, refer to the following.

AD75CK-type Cable Clamping Instruction Manual

- The length of the cable between the module and the drive unit is 1 to 3m generally. The length depends on the specifications of the drive unit. Review the specifications of the drive unit to be used.
- The length of the cable between the module and the encoder is as listed below generally. The length depends on the specifications of the encoder. Review the specifications of the encoder to be used. Use shielded twisted pair cable for the connection with the encoder.

| Encoder output type | Cable length |
|---|---|
| Differential output type | MAX. 30m |
| TTL type, open collector type | MAX. 3m |

- Connect the module and Servo ON signal of the drive unit without fail. In addition, do not turn on/off Servo ON signal externally. If Servo ON signal is not connected, the motor may rotate even in case of a CPU error.

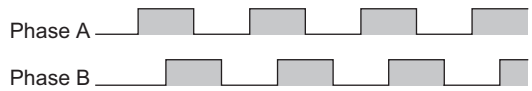
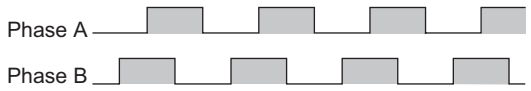
# 4.6.2 Precautions when connecting an encoder

This section describes precautions when connecting an encoder.

## (1) Operation of the QD73A1 (deviation counter and feedback pulses)

The deviation counter in the QD73A1 counts up and down.

An addition/subtraction switchover can be processed through the phases of feedback pulses.

| | |
|---|---|
| When feedback pulses are input with the phase A leading the phase B by 90°, the number of command pulses is subtracted. This input method is for counting positive command pulses when the speed command is positive voltage (when the motor is rotating forward). |  |
| When feedback pulses are input with the phase B leading the phase A by 90°, the number of command pulses is added. This input method is for counting negative command pulses when the speed command is negative voltage (when the motor is rotating reverse). |  |

If the sequence of the phase A and phase B is reversed, the number of command pulses and feedback pulses are counted together. This can cause an excessive error of accumulated pulses, resulting in the stop of the control.

### (a) Switch setting and the encoder

The rotation direction of the motor and the count process (negative or positive) of the command pulses depend on "Rotation direction setting" in the switch setting.

If the rotation direction of the motor that is set to "Rotation direction setting" in the switch setting is different from the encoder's rotation direction, the encoder rotates reverse when the motor rotates; therefore, the sequence of feedback phases also reverses.

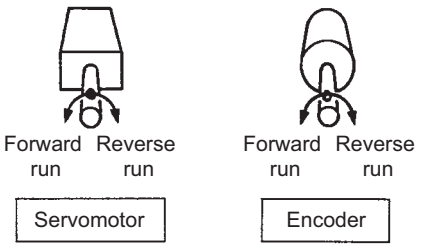
The rotation direction of the motor that is set to "Rotation direction setting" in the switch setting must be the same as the encoder's rotation direction.

For details on "Rotation direction setting" in the switch setting, refer to the following.

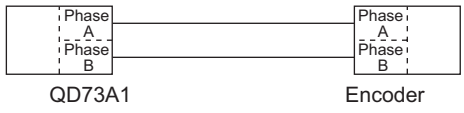
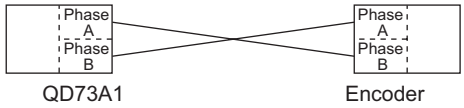
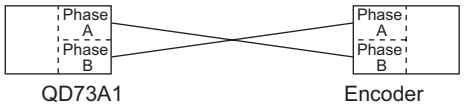
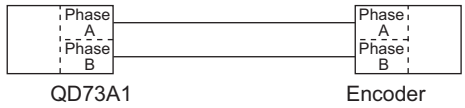
☞Page 102, Section 6.2.1

Connection examples depending on "Rotation direction setting" are as follows.

Ex. When the rotation directions of the motor and encoder are as below and the motor rotates forward when positive voltage is applied to the servo amplifier




Suppose the condition of the feedback pulses from the encoder as: the phase A is ahead of the phase B by 90° in case of forward run.

| Motor rotation direction | "Rotation direction setting" | Connection | |
|---|---|---|---|
| Forward run | Positive voltage is output when the positioning address increases. |   | When the rotation directions of the motor and the encoder are the same |
| | |   | When the rotation directions of the motor and the encoder are different |
| Reverse run | Negative voltage is output when the positioning address increases. |   | When the rotation directions of the motor and the encoder are the same |
| | |   | When the rotation directions of the motor and the encoder are different |

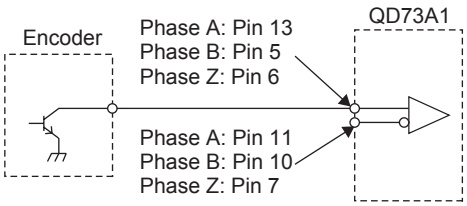
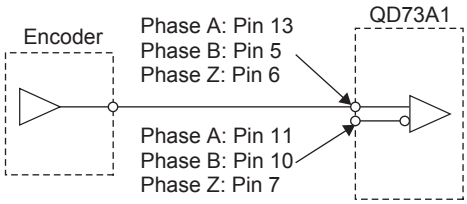
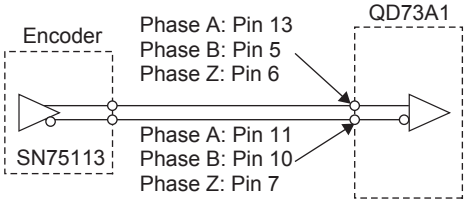
**Point**

If the connection of the QD73A1 and the encoder is incorrect, the motor rotates at a power-on and Excessive error signal (X17) turns on.

## (2) Connection between the QD73A1 and each type of encoder

The following table shows the connection between the QD73A1 and each type of encoder.
Set the output type of the encoder to be used in "Encoder I/F setting" of the switch setting.
For details on "Encoder I/F setting" in the switch setting, refer to the following.

☞Page 101, Section 6.2

| Encoder output type | "Encoder I/F setting" | Connection |
|---|---|---|
| Open collector output type | Open collector output |  |
| TTL output type | TTL output |  |
| Differential output type | Differential output |  |

# 4.6.3 External device connectors

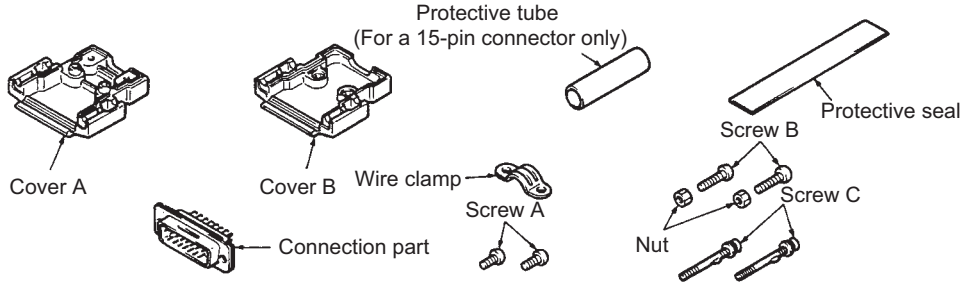
This section describes the assemblage of an external device connector and its connection method.

## (1) Assembling a connector

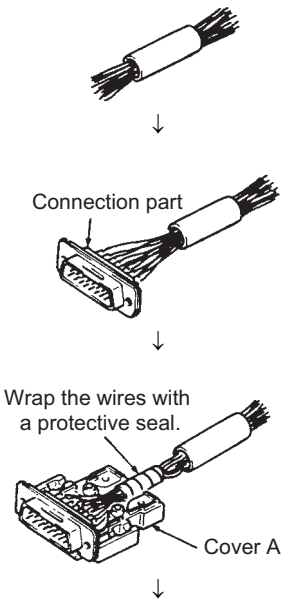
The following connectors are required to connect the QD73A1 and external devices.

- A 9-pin connector (pin type): For the CONT. connector (control signal connection)
- A 15-pin connector (pin type): For the SERVO connector (drive unit connection)

The connectors are composed of the following parts.




Assemble the connectors as follows.




***1.*** **Thread wires through the protection tube (for the 15-pin connector only).**

***2.*** **Solder the wires to the connection part.**

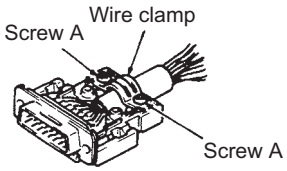
***3.*** **Attach the connection part to cover A, and wrap the protective seal around the part of the wires which contacts the wire clamp.**

***4.*** **Slide the protection tube over the protective seal (for the 15-pin connector only).**

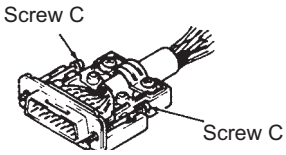
(To the next page)

(From the previous page)

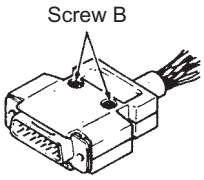
↓




↓




↓




↓

End

***5.*** **Fix the protective seal part or the protection tube part with the wire clamp using the screws A.**

***6.*** **Attach the screws C to the cover A.**

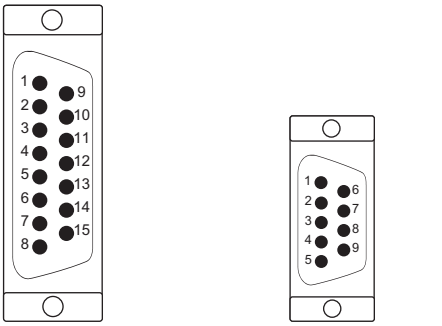
***7.*** **Put the cover B over the cover A, and fasten them using the screws B and nuts.**

## (2) Wiring connectors

The figure below shows the pin arrangement on the connectors.
Wire pins correctly according to the signal assigned to each pin number.
For details on the signal assigned to each pin number, refer to the following.

☞Page 44, Section 3.5.3

Pin arrangement viewed
from the wire side




15-pin connector
[Applies to the SERVO. connector]

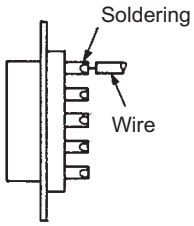
9-pin connector
[Applies to the CONT. connector]

### (a) Applicable wire size

The applicable wire size is 0.3mm$^2$ or less. If thicker wires are used, the wire clamp cannot be attached.

### (b) Connection between the connectors and wires

Solder the wires to the pins.
Strip parts of wire jackets properly to avoid a short circuit due to wire chips or solder chips.
If the signal line is exposed, malfunction may occur due to static electricity. Cover and protect the connector pins with heat shrinkable insulation tubes.



### (c) Connector type and the manufacturer

The following table lists applicable 9-pin connector and 15-pin connector. When wiring, use applicable wire and an appropriate tightening torque.

| | External wiring connector | | Wire | | | |
|---|---|---|---|---|---|---|
| | **Model** | **Tightening torque** | **Diameter** | **Type** | **Material** | **Temperature rating** |
| 9-pin connector for external wiring (pin type) | 17JE-23090-02(D8A) (manufactured by DDK Ltd.) | 0.20 to 0.29N • m | 28 to 24AWG | Stranded | Copper | 75°C or more |
| 15-pin connector for external wiring (pin type) | 17JE-23150-02(D8A) (manufactured by DDK Ltd.) | | | | | |

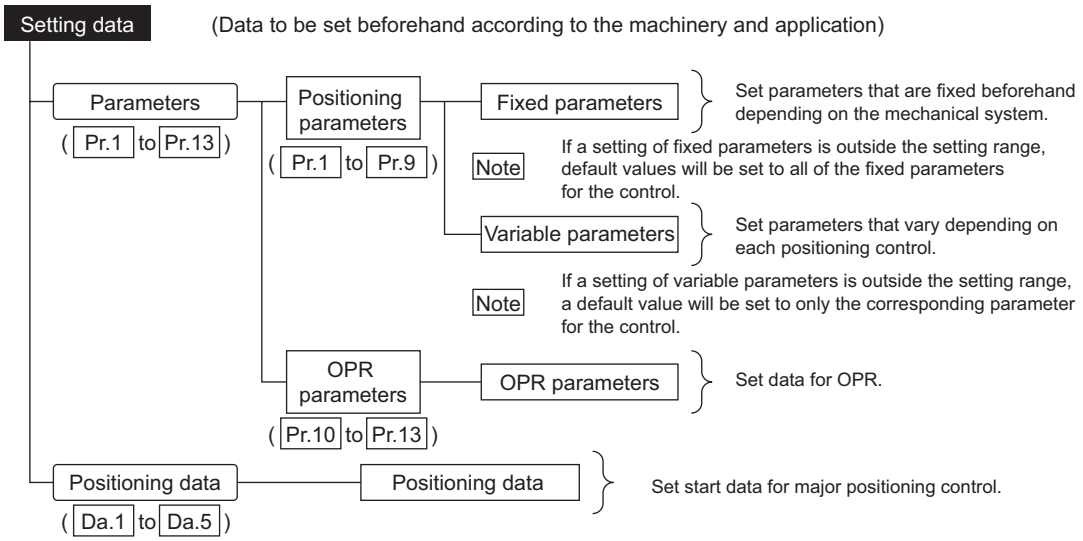
To contact the manufacturer regarding the connectors, refer to the following.
http://www.ddknet.co.jp/English/index.html

# CHAPTER 5 DATA USED FOR POSITIONING

This chapter describes parameters and data used for positioning.

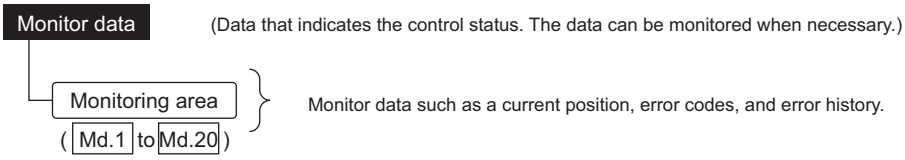
## 5.1 Types of Data

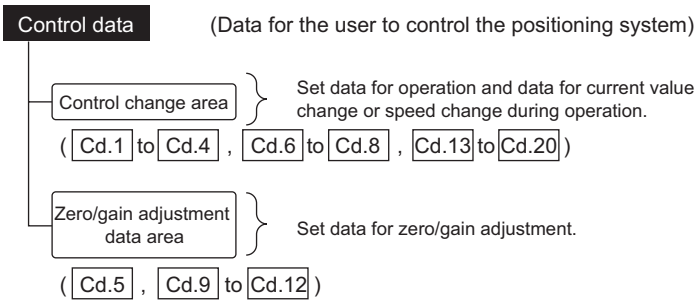
The parameters and data required to carry out control with the QD73A1 include "setting data", "monitor data", and "control data" shown below.


Setting data
(Data to be set beforehand according to the machinery and application)
Parameters
( Pr.1 to Pr.13 )
Positioning parameters
( Pr.1 to Pr.9 )
Fixed parameters
Set parameters that are fixed beforehand depending on the mechanical system.
Note
If a setting of fixed parameters is outside the setting range, default values will be set to all of the fixed parameters for the control.
Variable parameters
Set parameters that vary depending on each positioning control.
Note
If a setting of variable parameters is outside the setting range, a default value will be set to only the corresponding parameter for the control.
OPR parameters
( Pr.10 to Pr.13 )
OPR parameters
Set data for OPR.
Positioning data
( Da.1 to Da.5 )
Positioning data
Set start data for major positioning control.

**Point**

- The data can be set using GX Works2.
- Default values are determined for setting data parameters, and are set as the factory default. Keep the unused parameters to the default.
- Fixed parameters and OPR parameters are activated when PLC READY signal (Y2D) is turned on.
- Variable parameters and positioning data can be changed even when PLC READY signal (Y2D) is on. Although, the change that is made during operation is not reflected since the data set at the start of major positioning control or JOG operation are valid. The change will be reflected at the next start.


Monitor data
(Data that indicates the control status. The data can be monitored when necessary.)
Monitoring area
( Md.1 to Md.20 )
Monitor data such as a current position, error codes, and error history.


Control data
(Data for the user to control the positioning system)
Control change area
Set data for operation and data for current value change or speed change during operation.
( Cd.1 to Cd.4 , Cd.6 to Cd.8 , Cd.13 to Cd.20 )
Zero/gain adjustment data area
Set data for zero/gain adjustment.
( Cd.5 , Cd.9 to Cd.12 )

**Point**

Set control data using sequence programs.

# 5.2 Positioning Parameters

This section describes the details of positioning parameters.

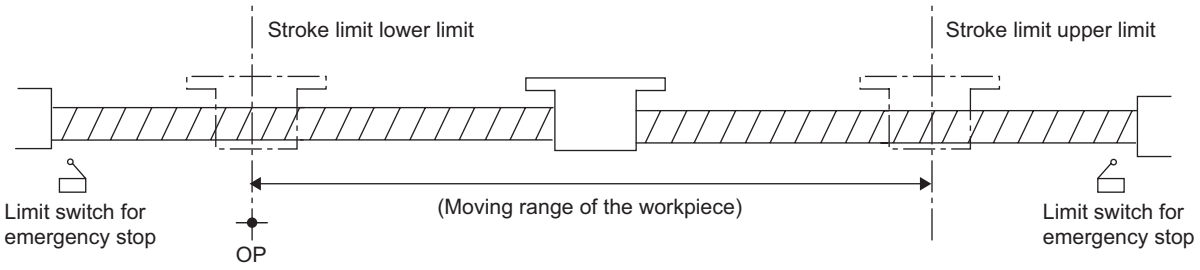
| Item | | | Setting range | Default value | Buffer memory address (decimal) | Reference |
|---|---|---|---|---|---|---|
| Fixed parameter | Pr.1 | Stroke limit upper limit | -2147483648 to 2147483647pulse | 2147483647pulse | 0<br>1 | Page 77, Section 5.2 (1) |
| | Pr.2 | Stroke limit lower limit | | 0pulse | 2<br>3 | |
| | Pr.3 | Numerator of command pulse multiplication for electronic gear (CMX) | 1 to 9999<br>(Satisfy the following condition.<br>1/50 ≤ CMX/CDV ≤ 50) | 1 | 4 | Page 78, Section 5.2 (2) |
| | Pr.4 | Denominator of command pulse multiplication for electronic gear (CDV) | | | 5 | |
| Variable parameter | Pr.5 | Speed limit value | 10 to 4000000pulse/s<br>(Set in the unit of 10pulse/s.) | 200000pulse/s | 20<br>21 | Page 78, Section 5.2 (3) |
| | Pr.6 | Acceleration time | 2 to 9999ms | 300ms | 22 | Page 79, Section 5.2 (4) |
| | Pr.7 | Deceleration time | | | 23 | |
| | Pr.8 | In-position range | 1 to 20479pulse | 5pulse | 24 | Page 79, Section 5.2 (5) |
| | Pr.9 | Positioning mode | 0: Position control mode<br>1: Speed-position control switch mode | 0: Position control mode | 25 | Page 79, Section 5.2 (6) |

**Point**

- The set data of fixed parameters are activated when PLC READY signal (Y2D) is turned on, and the error check is executed at the same time.
- Variable parameters can be set any time, but the error check is executed when a start signal is turned on.

### (1) Pr.1 Stroke limit upper limit, Pr.2 Stroke limit lower limit

Set the upper and lower limits of the workpiece moving range.


Stroke limit lower limit
Stroke limit upper limit
Limit switch for emergency stop
(Moving range of the workpiece)
Limit switch for emergency stop
OP

For details on the stroke limit function, refer to the following.

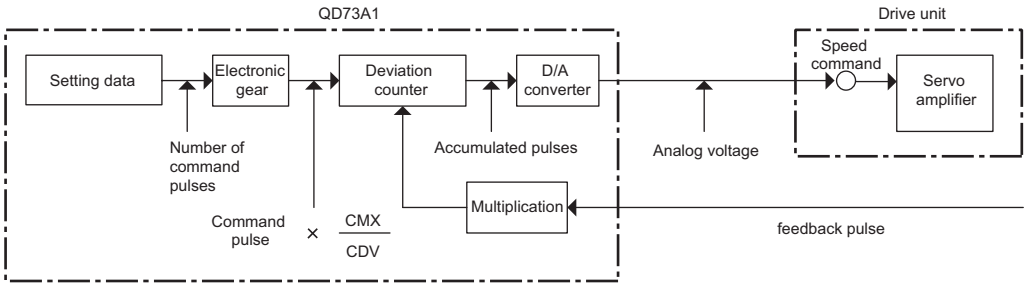
☞Page 211, Section 11.3

**Remark**

- In general, the OP is set at the lower limit or upper limit of the stroke limit.
- Setting the upper and lower limits of the stroke limit prevents the workpiece to overrun the set range; although, in addition, place emergency stop limit switches (upper limit switch (FLS)/lower limit switch (RLS)) outside and near the stroke limit range.
- The stroke limits are not checked during speed control.
- To disable the stroke limit function, set the same value to " Pr.1 Stroke limit upper limit" and " Pr.2 Stroke limit lower limit".

## (2) Pr.3 Numerator of command pulse multiplication for electronic gear, Pr.4 Denominator of command pulse multiplication for electronic gear

Set the numerator (CMX) and denominator (CDV) of command pulse multiplication for electronic gear.




For details on the electronic gear function, refer to the following.

Page 207, Section 11.1

**Remark**

- Machine movement amount per one command pulse can be changed using the command pulse multiplication setting.
- Electronic gear is active on all of OPR control, major positioning control, and JOG operation.
- The module operates with the positioning speed and movement amount that are multiplied by the set value for electronic gear. Satisfy the following condition when setting electronic gear.
  Positioning speed × Electronic gear ≤ 4Mpulse/s
  When the positioning speed value that is multiplied by the set value of electronic gear exceeds "Pr.5 Speed limit value", the limit value is ignored. On the other hand, if the speed exceeds 4Mpulse/s, the error "Outside the command frequency range" (error code: 104) occurs. In this case, the speed is 4Mpulse/s, resulting in a positioning error.
- When there are decimal pulses, the fractions are maintained inside and accumulated for the next command.
- If positioning is continued after the CPU module was reset, a positioning error by the fractions of pulses occurs due to electronic gear (when CMX/CDV ≠ 1). In that case, execute OPR.

## (3) Pr.5 Speed limit value

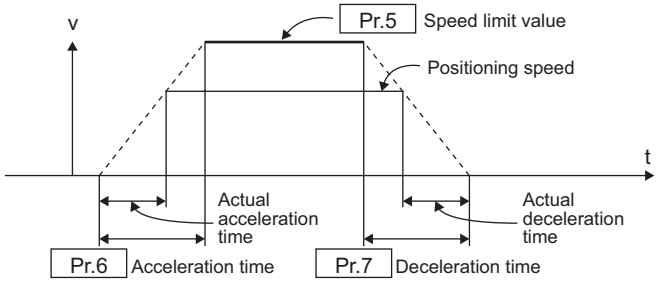
Set the upper limit speed of major positioning control or JOG operation. If command speed that is faster than this limit is specified, the speed is limited to this value.

**Remark**

- If speed for OPR control is set to the one faster than "Pr.5 Speed limit value", the error "OPR speed Outside the setting range" (error code: 20) occurs at the start of OPR.
- Positioning speed must be limited properly depending on the device and control subject.
- Set a value in a unit of 10 pulses. If a single digit is set, the value is rounded off.

### (4) Pr.6 Acceleration time, Pr.7 Deceleration time

- Pr.6 Acceleration time: Set the time takes for speed (0) to reach the value in " Pr.5 Speed limit value".
- Pr.7 Deceleration time: Set the time takes for the speed (the value in " Pr.5 Speed limit value") to reach 0.




**Remark**

- The parameters are active for OPR control, major positioning control, and JOG operation.
- When the set positioning speed is lower than the value in " Pr.5 Speed limit value", the actual acceleration/deceleration time is shorter than the set value of the parameters.

### (5) Pr.8 In-position range

Set the accumulated pulse amount where In-position signal (X16) turns on.
In-position signal (X16) can be used as the signal right before Positioning complete signal (X15).
For details on the in-position function, refer to the following.

Page 219, Section 11.8

### (6) Pr.9 Positioning mode

Select a control mode of major positioning from the position control mode or the speed-position control switch mode.

**Point**

If a value other than 0 and 1 is set, the error "Positioning mode Outside the setting range" (error code: 14) occurs. Although, the QD73A1 checks the setting range only for the start by Forward start signal (Y22) or Reverse start signal (Y23). For the start by the following signals, the above error does not occur even if the set value is outside the setting range.

- OPR start signal (Y20)
- Absolute positioning start signal (Y21)
- Forward JOG start signal (Y24)
- Reverse JOG start signal (Y25)

# 5.3 OPR Parameters

This section describes the details of OPR parameters.

| Item | | Setting range | Default value | Buffer memory address (decimal) | Reference |
|---|---|---|---|---|---|
| Pr.10 | OP address | -2147483648 to 2147483647pulse | 0pulse | 40<br>41 | Page 80, Section 5.3 (1) |
| Pr.11 | OPR speed | 1 to 4000000pulse/s | 10000pulse/s | 42<br>43 | Page 80, Section 5.3 (2) |
| Pr.12 | Creep speed | 1 to 4000000pulse/s | 1000pulse/s | 44<br>45 | Page 81, Section 5.3 (3) |
| Pr.13 | Setting for the movement amount after near-point dog ON | 0 to 2147483647pulse | 75pulse | 46<br>47 | Page 82, Section 5.3 (4) |

**Point**

The set data of OPR parameters are activated when PLC READY signal (Y2D) is turned on, and the error check is executed when OPR start signal (Y20) is turned on.

For details on OPR control, refer to the following.

☞Page 176, CHAPTER 8

### (1) Pr.10 OP address

Set the address that is the reference point of major positioning control.

Upon completion of OPR, the set value is stored in the current value monitor ("Md.1 Current feed value" and "Md.2 Actual current value").

### (2) Pr.11 OPR speed

Set the speed of OPR control.

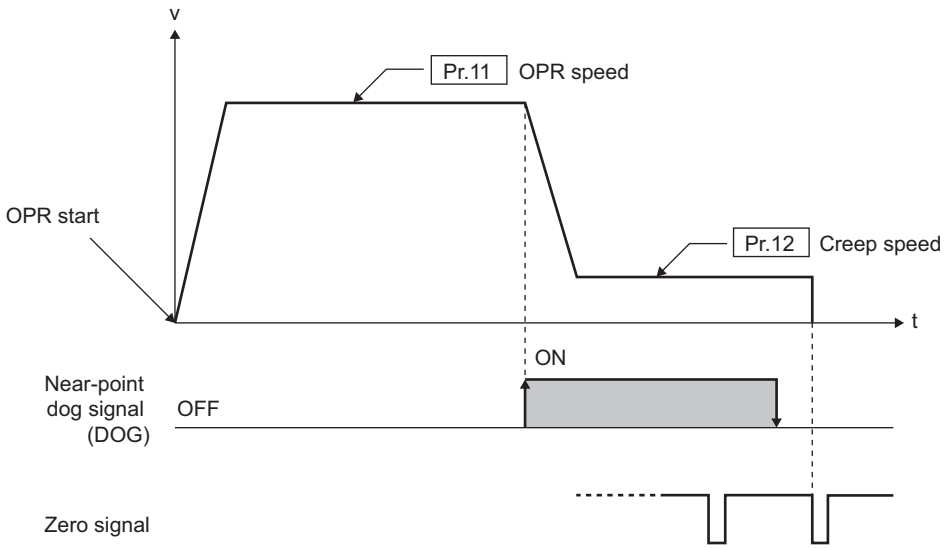
Satisfy the following condition when setting the speed.

Pr.12 Creep speed ≤ Pr.11 OPR speed ≤ Pr.5 Speed limit value

If the OPR speed exceeds "Pr.5 Speed limit value", the error "OPR speed Outside the setting range" (error code: 20) occurs, and the OPR is not executed.

### (3) Pr.12 Creep speed

Once the near-point dog turns on, the control decelerates from "Pr.11 OPR speed" and stops. Set the speed of right before the stop, which is a creep speed.




Satisfy the following condition when setting the speed.

Pr.12 Creep speed ≤ Pr.11 OPR speed ≤ Pr.5 Speed limit value

If the creep speed exceeds "Pr.11 OPR speed", the error "Creep speed Outside the setting range" (error code: 21) occurs, and the OPR is not executed.

## (4) Pr.13 Setting for the movement amount after near-point dog ON

When the OPR method is the count method, set the movement amount from the position where Near-point dog signal (X1C) turns on to the original point. Set a value equal to or greater than the deceleration distance from the OPR speed to the creep speed.

$$\text{Deceleration distance (pulse)} = \frac{\text{(OPR speed + Creep speed) (pulse/s)}}{1000} \times \frac{\text{Actual deceleration time (ms)}}{2}$$

The following are the setting precautions.

- Set pulse amount so that the position moved from the near-point dog ON does not overlap with Zero signal.
- Calculate deceleration distance without the use of electronic gear.

The following is a setting example.

**Ex.** When parameters are set as follows.

- Pr.11 OPR speed: 10kpulse/s (default value)
- Pr.12 Creep speed: 1kpulse/s (default value)
- Pr.7 Deceleration time: 300ms (default value)

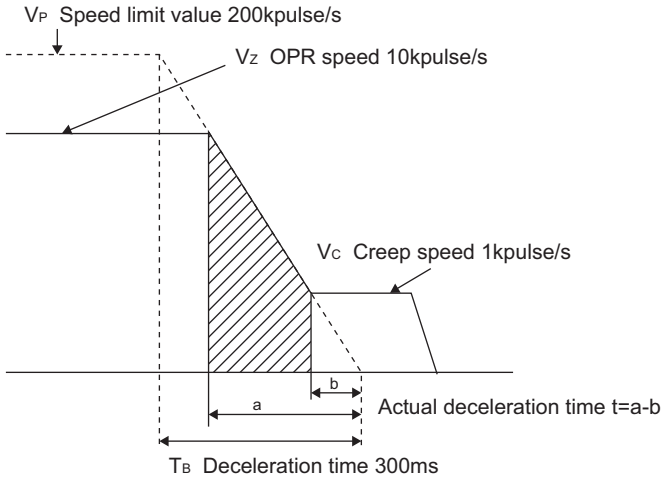
$$\text{Deceleration distance} = \frac{V_Z + V_C}{1000} \times \frac{t}{2}$$

$$= \frac{V_Z + V_C}{1000} \times \frac{1}{2} \times \frac{T_B(V_Z - V_C)}{Vp}$$

$$= \frac{(10k + 1k) \times 300(10k - 1k)}{2000 \times 200k}$$

$$= 74.25$$

$$= 75 \text{ (rounded up to the nearest integer)}$$




### Point

When the position where the near-point dog turns on is set near the center of Zero signals, " Pr.13 Setting for the movement amount after near-point dog ON" should be an integral multiple of pulses per one servomotor rotation. Then the position moved after the near-point dog ON does not overlap with Zero signal.
For instance, when the number of pulses per one servomotor rotation is 2000, set 2000 pulses.

# 5.4 Positioning Data

This section describes the details of positioning data.

| Item | | Setting range | Default value | Buffer memory address (decimal) | Reference |
|---|---|---|---|---|---|
| Da.1 | Positioning pattern | 0: Positioning control<br>1: Two-phase trapezoidal positioning control | 0: Positioning control | 301 | Page 83, Section 5.4 (1) |
| Da.2 | Positioning address P1 | Absolute system:<br>-2147483648 to 2147483647pulse<br>Incremental system:<br>0 to 2147483647pulse | 0pulse | 302<br>303 | Page 84, Section 5.4 (2) |
| Da.3 | Positioning speed V1 | 1 to 4000000pulse/s | 0pulse/s | 304<br>305 | Page 85, Section 5.4 (3) |
| Da.4 | Positioning address P2 | Absolute system:<br>-2147483648 to 2147483647pulse<br>Incremental system:<br>0 to 2147483647pulse | 0pulse | 306<br>307 | Page 85, Section 5.4 (4) |
| Da.5 | Positioning speed V2 | 1 to 4000000pulse/s | 0pulse/s | 308<br>309 | Page 85, Section 5.4 (5) |

**Point**

Positioning data can be set any time, but the error check is executed when a positioning start signal (Y21 to Y23) is turned on.

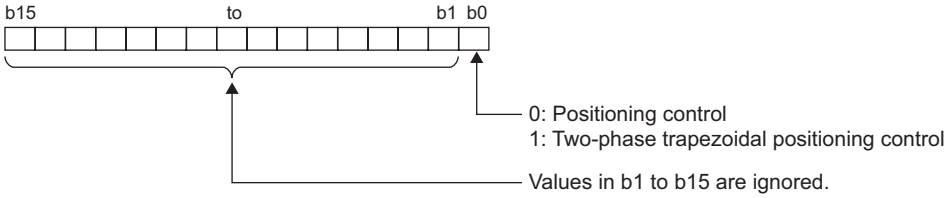
For details on positioning control, two-phase trapezoidal positioning control, and speed-position control switch mode, refer to the following.

Page 183, CHAPTER 9

## (1) Da.1 Positioning pattern

Select a control pattern of major positioning from "positioning control" or "two-phase trapezoidal positioning control".

When 0 is set in b0, positioning control is specified, and when 1 is set in b0, two-phase trapezoidal positioning control is specified.



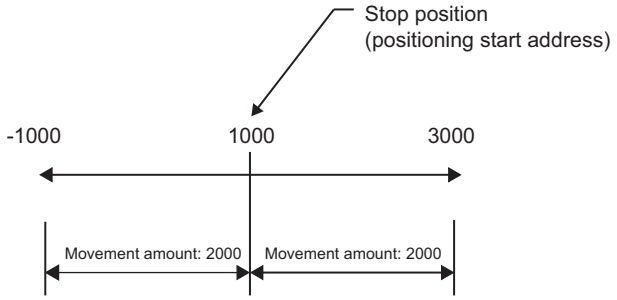
## (2) Da.2 Positioning address P1

Set the address that is the destination of major positioning control. The setting range depends on the type of major positioning control.

If the specified positioning address is outside the stroke range, the error "Positioning address Outside the setting range" (error code: 30) occurs, and the positioning does not start.

### (a) Absolute system

When the absolute system is selected, set an absolute address (movement amount from the OP).

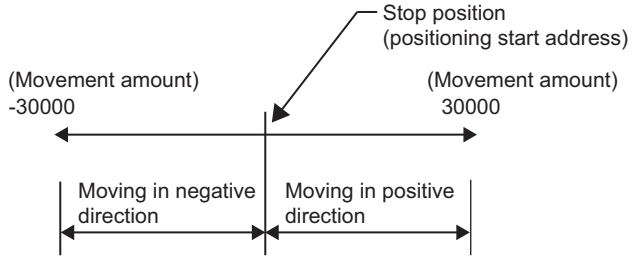



To execute two-phase trapezoidal positioning control in the absolute system, the positioning direction from "Da.2 Positioning address P1" to "Da.4 Positioning address P2" and the positioning direction from the current value to "Da.2 Positioning address P1" must be the same.

If not, the error "Two-phase trapezoidal positioning address error" (error code: 31) occurs, and the two-phase trapezoidal positioning control does not start.

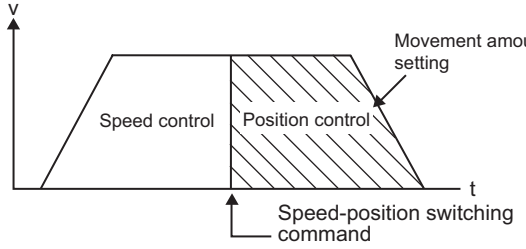
### (b) Incremental system

When the incremental system is selected, set movement amount from the current value.




### (c) Speed-position control switch mode

Set movement amount of after the shift from speed control to position control.



### (3) Da.3 Positioning speed V1

Set the command speed of major positioning control. Set a value equal to or less than "Pr.5 Speed limit value".

If the value exceeds "Pr.5 Speed limit value", the error "Positioning speed Outside the setting range" (error code: 32) occurs, and the command speed is limited to "Pr.5 Speed limit value".

If the specified positioning speed is 0, the error "Positioning speed Outside the setting range" (error code: 32) occurs, and the positioning does not start.

### (4) Da.4 Positioning address P2

This setting is enabled only for two-phase trapezoidal positioning control.

Set the destination address of after the move to the address set to "Da.2 Positioning address P1".

For details on "Da.2 Positioning address P1", refer to the following.

☞ Page 84, Section 5.4 (2)

### (5) Da.5 Positioning speed V2

This setting is enabled only for two-phase trapezoidal positioning control.

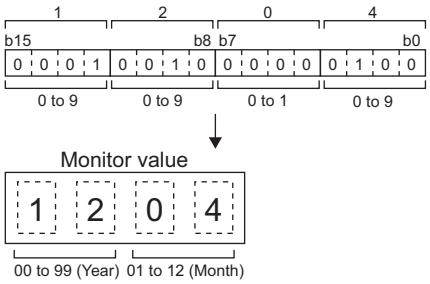
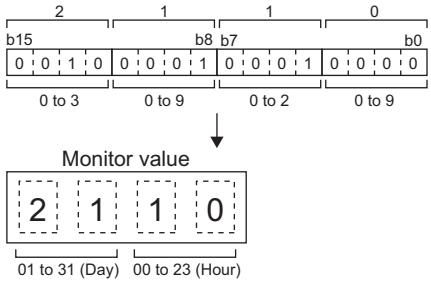
Set the command speed to move to the address set to "Da.4 Positioning address P2".

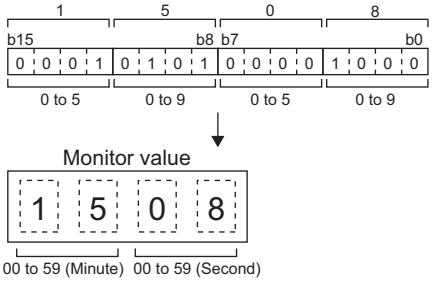
The setting condition is the same as that of "Da.3 Positioning speed V1". (☞ Page 85, Section 5.4 (3))

# 5.5 Monitor Data

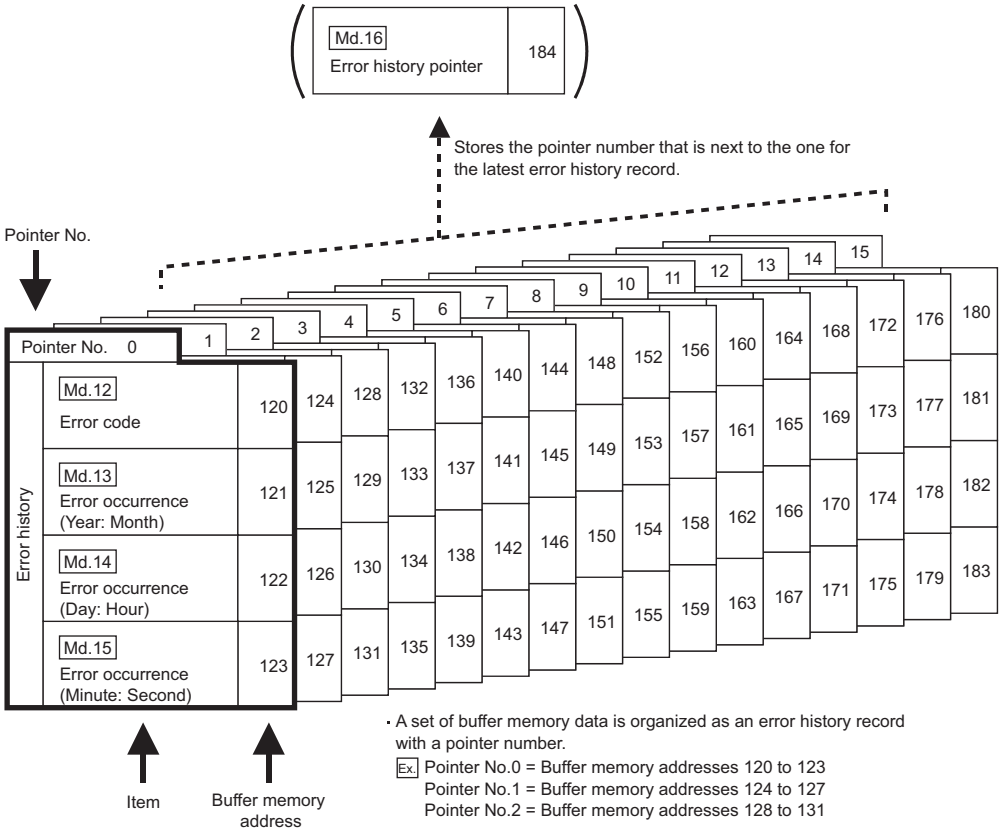
This section describes the details of monitor data.

| Item | | Description | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|
| Md.1 | Current feed value | • The current commanded position is stored. (different from the actual motor position during operation)<br>• The update cycle is 0.5ms.<br>• When OPR is completed, the value of " Pr.10 OP address" is stored.<br>• When the current value is changed with the current value change function, the changed value is stored. (☞ Page 215, Section 11.5) | 0pulse | 100<br>101 |
| Md.2 | Actual current value | • The actual servomotor movement amount calculated based on feedback pulses is stored as an actual current value (the number of feedback pulses). (Actual current value = Current feed value - Accumulated pulses in the deviation counter)<br>• The update cycle is 0.5ms. | 0pulse | 102<br>103 |
| Md.3 | Error code (ERR.1) | • When a minor error occurs, the corresponding error code is stored.<br>• The latest error code is stored at all times. (When a new error occurs, the error code is overwritten.)<br>• When Error reset signal (Y28) is turned on, the error code is cleared to 0.<br>For details on error codes, refer to the following.<br>☞ Page 248, Section 14.3 | 0 | 104 |
| Md.4 | Error code (ERR.2) | • When a major error occurs, the corresponding error code is stored.<br>• The latest error code is stored at all times. (When a new error occurs, the error code is overwritten.)<br>• When Error reset signal (Y28) is turned on, the error code is cleared to 0.<br>For details on error codes, refer to the following.<br>☞ Page 248, Section 14.3 | 0 | 105 |
| Md.5 | Deviation counter value | • The following value is stored as a deviation counter value.<br>Command pulse × CMX/CDV - Number of feedback pulses × Multiplication<br>• The update cycle is 0.5ms. | 0pulse | 106<br>107 |
| Md.6 | Movement amount after near-point dog ON | • When OPR starts, "0" is stored.<br>• When OPR is completed, the movement amount from the near-point dog ON to the OPR completion is stored. (Movement amount: Movement amount to OPR completion using near-point dog ON as "0".)<br>• The count value is stored for both the near-point dog method and the count method. | 0pulse | 108<br>109 |
| Md.7 | Speed-position switching command | The on/off status of Speed-position switching command signal (CHANGE) is stored.<br>0: Speed-position switching command input OFF<br>1: Speed-position switching command input ON | 0: Speed-position switching command input OFF | 110 |
| Md.8 | Control mode | The control mode under the speed-position control switch mode is stored.<br>0: Position control<br>1: Speed control | 0: Position control | 111 |

| Item | | Description | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|
| Md.9 | Zero/gain execution status | The execution status of the zero/gain adjustment mode is stored.<br>0: Not in the zero/gain adjustment mode<br>1: In the zero/gain adjustment mode (DIP switch)<br>2: In the zero/gain adjustment mode (switch setting) | 0: Not in the zero/gain adjustment mode | 112 |
| Md.10 | Zero/gain adjustment status | The status of zero/gain adjustment is stored.<br>0: No zero/gain adjustment<br>1: Adjusting zero<br>2: Adjusting gain | 0: No zero/gain adjustment | 113 |
| Md.11 | Feedrate | • The command output speed of the operating workpiece is stored. (May be different from the actual motor speed during operation)<br>• The update cycle is 0.5ms. | 0pulse/s | 114<br>115 |
| Md.12 | Error code | An error code is stored.<br>For details on error codes, refer to the following.<br>☞ Page 248, Section 14.3 | 0 | ☞ Page 89, Section 5.5 (1) |
| Md.13 | Error occurrence (Year: Month) | The time (year: month) of error detection is stored in BCD code.<br>• b15 to b8: Year<br>• b7 to b0: Month<br>The data can be monitored in hexadecimal.<br>  | $0000_H$ | |
| Md.14 | Error occurrence (Day: Hour) | The time (day: hour) of error detection is stored in BCD code.<br>• b15 to b8: Day<br>• b7 to b0: Hour<br>The data can be monitored in hexadecimal.<br>  | $0000_H$ | |

| Item | | Description | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|
| Md.15 | Error occurrence (Minute: Second) | The time (minute: second) of error detection is stored in BCD code.<br>• b15 to b8: Minute<br>• b7 to b0: Second<br>The data can be monitored in hexadecimal.<br>  | $0000_H$ | ☞ Page 89, Section 5.5 (1) |
| Md.16 | Error history pointer | • The pointer No. for the next error record is stored. A value from 0 to 15 is stored.<br>• Even when Error reset signal (Y28) is turned on, the data is not cleared to 0. | 0 | 184 |
| Md.17 | Maximum accumulated pulse value | [When the accumulated pulse error detection function is being executed]<br>The reference value that is kept in the flash ROM of the QD73A1 is displayed.<br>[When the reference value is being measured]<br>The maximum/minimum accumulated pulse values are stored when the positioning is executed in the address increasing/decreasing direction.<br>[In other cases]<br>0 is stored. | 0 pulse | 200<br>201 |
| Md.18 | Minimum accumulated pulse value | | 0 pulse | 202<br>203 |
| Md.19 | Accumulated pulse error detection function status | The status of the accumulated pulse error detection function is displayed.<br>0: Normal<br>1: Accumulated pulse error is being detected<br>2: Reference value is being measured | 0: Normal | 204 |
| Md.20 | Reference value measurement flag | The status of the reference value measurement is displayed.<br>0: Unmeasured<br>1: Measured<br><br>Check that this area stores 1 before writing data in the flash ROM.<br><br>This area becomes 0 at the following timing.<br>• When the module is started<br>• When " Cd.18 Accumulated pulse error detection request" is set to 1 and the error detection starts | 0: Unmeasured | 205 |

## (1) Buffer memory areas for error occurrence data




- A set of buffer memory data is organized as an error history record with a pointer number.

Ex. Pointer No.0 = Buffer memory addresses 120 to 123
Pointer No.1 = Buffer memory addresses 124 to 127
Pointer No.2 = Buffer memory addresses 128 to 131

Pointer No.15 = Buffer memory addresses 180 to 183

- Error history records are stored from the pointer No.1 up to No.15. After 16 records are stored, the next record will be assigned the pointer No.0. (The new record replaces the older record.)

# 5.6 Control Data

This section describes the details of control data.

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.1 | New current value | • Set a new current feed value when changing the current value.<br>• Writing data in this area and setting "1" in "Cd.7 Current value change request" changes the value in "Md.1 Current feed value".<br>For details on the current value change function, refer to the following.<br>Page 215, Section 11.5 | -2147483648 to 2147483647pulse | 0pulse | 80<br>81 |
| Cd.2 | New speed value | • Set a new speed value when changing speed.<br>• Writing data in this area and setting "1" in "Cd.8 Speed change request" executes the speed change.<br>For details on the speed change function, refer to the following.<br>Page 216, Section 11.6 | 0 to "Pr.5 Speed limit value" (pulse/s)<br>(Maximum 4000000 pulse/s) | 0pulse/s | 82<br>83 |
| Cd.3 | JOG speed | • Set JOG speed for JOG operation.<br>• If the value exceeds "Pr.5 Speed limit value", the error "JOG speed Outside the setting range" (error code: 41) occurs, and the speed is limited to "Pr.5 Speed limit value".<br>• If "0" is set in this area and JOG operation is attempted, the error "JOG speed Outside the setting range" (error code: 41) occurs, and the operation does not start.<br>For details on JOG operation, refer to the following.<br>Page 198, CHAPTER 10 | 1 to 4000000pulse/s | 0pulse/s | 84<br>85 |

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.4 | Deviation counter clear command | • Use this area to clear the accumulated pulses in the deviation counter.<br>• Write "1" to clear the counter. If a value other than "1" is set, the command is ignored.<br>• After the deviation counter was cleared, "0" is stored automatically.<br>• To start positioning after the deviation counter was cleared, check that this area stores "0" and no error is detected before the start.<br>• When the deviation counter is cleared, " Md.2 Actual current value" changes to the value in " Md.1 Current feed value".<br>• Data cannot be written while BUSY signal (X14) is on. Check that BUSY signal (X14) is off before writing data. If data writing is attempted while BUSY signal (X14) is on, the error "Deviation counter clear error" (error code: 114) occurs.<br>For details on the deviation counter clear function, refer to the following.<br>☞ Page 218, Section 11.7 | 1: Clear the deviation counter | 0 | 86 |
| Cd.5 | Analog output adjustment area 1 | • Set pulse amount to adjust gain with specific accumulated pulse amount.<br>• This setting is enabled only in the zero/gain adjustment mode.<br>• Use this area when the default value or one of the selections 1 to 4 is set in "Accumulated pulse setting" in the switch setting. (When one of the selections 5 to 8 is set, use " Cd.9 Analog output adjustment area 2".)<br>• If the setting is outside the setting range, the error "Analog output adjustment area 1 Outside the setting range" (error code: 125) occurs.<br>For details on zero/gain adjustment, refer to the following.<br>☞ Page 60, Section 4.5 | Depends on "Accumulated pulse setting" in the switch setting.<br>Accumulated pulse setting / Setting range (Unit: pulse)<br>Selection 1: -3700 to 3700<br>Selection 2: -7400 to 7400<br>Selection 3: -11100 to 11100<br>Default value or selection 4: -14800 to 14800 | 0 | 87 |
| Cd.6 | New speed-position movement amount | • Set this area to change movement amount of after a switchover to position control in the speed-position control switch mode.<br>• The set value is reflected at the input of Speed-position switching command signal (CHANGE).<br>• The setting is cleared to 0 when the next operation starts.<br>For details on the Speed-position control switch mode, refer to the following.<br>☞ Page 193, Section 9.6.2 | 1 to 2147483647pulse | 0pulse | 88<br>89 |

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.7 | Current value change request | • Use this area to request a current value change.<br>• After setting "Cd.1 New current value", set "1" in this area. If a value other than "1" is set, the setting is ignored.<br>• After the current value change was accepted, "0" is stored automatically.<br>• A current value change cannot be requested while BUSY signal (X14) is on. Check that BUSY signal (X14) is off before requesting a current value change.<br>• If a current value change is requested while BUSY signal (X14) is on, the error "Current value change error" (error code: 110) occurs.<br>For details on the current value change function, refer to the following.<br>☞ Page 215, Section 11.5 | 1: Change the current value | 0 | 90 |
| Cd.8 | Speed change request | • Use this area to request a speed change.<br>• After setting "Cd.2 New speed value", set "1" in this area. If a value other than "1" is set, the setting is ignored.<br>• After the speed change was accepted, "0" is stored automatically.<br>• If a speed change is requested with "Cd.2 New speed value" exceeding "Pr.5 Speed limit value", the error "New speed value Outside the setting range" (error code: 40) occurs, and the speed after the change is limited to "Pr.5 Speed limit value".<br>For details on the speed change function, refer to the following.<br>☞ Page 216, Section 11.6 | 1: Change speed | 0 | 91 |
| Cd.9 | Analog output adjustment area 2 | • Set pulse amount to adjust gain with specific accumulated pulse amount.<br>• This setting is enabled only in the zero/gain adjustment mode.<br>• Use this area when one of the selections 5 to 8 is set in "Accumulated pulse setting" in the switch setting. (When one of the selections 1 to 4 is set, use "Cd.5 Analog output adjustment area 1".)<br>• If the setting is outside the setting range, the error "Analog output adjustment area 2 Outside the setting range" (error code: 126) occurs.<br>For details on zero/gain adjustment, refer to the following.<br>☞ Page 60, Section 4.5 | Depends on "Accumulated pulse setting" in the switch setting.<br>Accumulated pulse setting / Setting range (Unit: pulse)<br>Selection 5: -37000 to 37000<br>Selection 6: -74000 to 74000<br>Selection 7: -111000 to 111000<br>Selection 8: -148000 to 148000 | 0 | 92<br>93 |

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.10 | Zero/gain adjustment specification | • Specify "zero adjustment" or "gain adjustment".<br>• When zero/gain adjustment is performed using switches on the front of the QD73A1, the set value is ignored.<br>• If a value other than 0, 1, and 2 is set, the error "Zero/gain adjustment setting error" (error code: 123) occurs.<br>For details on zero/gain adjustment, refer to the following.<br>☞ Page 60, Section 4.5 | 1: Zero adjustment<br>2: Gain adjustment | 0 | 94 |
| Cd.11 | Zero/gain adjustment value specification | • Use this area to set adjustment amount of the analog output value during zero/gain adjustment.<br>• The analog output value changes by the adjustment amount when Set value change request signal (Y1C) is turned on and off.<br>**Ex.** When 1000 is set, the analog output value can be adjusted by approximately 0.33V.<br>• When zero/gain adjustment is performed using switches on the front of the QD73A1, the set value is ignored.<br>• If the setting is outside the setting range, the error "Zero/gain adjustment value error" (error code: 124) occurs.<br>For details on zero/gain adjustment, refer to the following.<br>☞ Page 60, Section 4.5 | -3000 to 3000 | 0 | 95 |
| Cd.12 | Factory default zero/gain adjustment value restoration request | • Use this area to restore the zero adjustment value and gain adjustment value to the factory default.<br>• This setting is enabled only in the zero/gain adjustment mode.<br>• If a value other than "1" is set, the setting is ignored.<br>• After the zero/gain adjustment value was restored, "0" is stored automatically. | 1: Restore the zero/gain adjustment value | 0 | 96 |

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.13 | Alert output accumulated pulse setting value (maximum value) | The difference between the reference value (maximum value) and the judgment value (alert output accumulated pulses (maximum value)) is set.<br>The relation between this setting and the judgment value is as follows.<br><br>[If " Cd.17 Accumulated pulse setting value selection" is set to 0]<br><br>Alert output accumulated pulses (maximum value) = reference value (maximum value) + Cd.13 Alert output accumulated pulse setting value (maximum value)<br><br>[If " Cd.17 Accumulated pulse setting value selection" is set to 1]<br><br>Alert output accumulated pulses (maximum value) = reference value (maximum value) + ( Cd.13 Alert output accumulated pulse setting value (maximum value) - 1000) × reference value (maximum value) ÷ 1000<br><br>For details on the accumulated pulse error detection function, refer to the following.<br>☞ Page 221, Section 11.9 | • If " Cd.17 Accumulated pulse setting value selection" is set to 0: 1 to 148000 pulse<br>• If " Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000<br>(× $10^{-3}$: Last three digits are the value after the decimal point.) | 0 | 400<br>401 |

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.14 | Immediate stop accumulated pulse setting value (maximum value) | The difference between the reference value (maximum value) and the judgment value (immediate stop accumulated pulses (maximum value)) is set.<br>The relation between this setting and the judgment value is as follows.<br><br>[If " Cd.17 Accumulated pulse setting value selection" is set to 0]<br><br>Immediate stop accumulated pulses (maximum value) = reference value (maximum value) + Cd.14 Immediate stop accumulated pulse setting value (maximum value)<br><br>[If " Cd.17 Accumulated pulse setting value selection" is set to 1]<br><br>Immediate stop accumulated pulses (maximum value) = reference value (maximum value) + ( Cd.14 Immediate stop accumulated pulse setting value (maximum value) - 1000) × reference value (maximum value) ÷ 1000<br><br>For details on the accumulated pulse error detection function, refer to the following.<br>☞ Page 221, Section 11.9 | • If " Cd.17 Accumulated pulse setting value selection" is set to 0: 1 to 148000 pulse<br>• If " Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000<br>(× $10^{-3}$: Last three digits are the value after the decimal point.) | 0 | 402<br>403 |

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.15 | Alert output accumulated pulse setting value (minimum value) | The difference between the reference value (minimum value) and the judgment value (alert output accumulated pulses (minimum value)) is set.<br>The relation between this setting and the judgment value is as follows.<br><br>[If " Cd.17 Accumulated pulse setting value selection" is set to 0]<br><br>Alert output accumulated pulses (minimum value) = reference value (minimum value) + Cd.15 Alert output accumulated pulse setting value (minimum value)<br><br>[If " Cd.17 Accumulated pulse setting value selection" is set to 1]<br><br>Alert output accumulated pulses (minimum value) = reference value (minimum value) + ( Cd.15 Alert output accumulated pulse setting value (minimum value) - 1000) × reference value (minimum value) ÷ 1000<br><br>For details on the accumulated pulse error detection function, refer to the following.<br>☞ Page 221, Section 11.9 | • If " Cd.17 Accumulated pulse setting value selection" is set to 0: -148000 to -1 pulse<br>• If " Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000<br>(× $10^{-3}$: Last three digits are the value after the decimal point.) | 0 | 404<br>405 |

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.16 | Immediate stop accumulated pulse setting value (minimum value) | The difference between the reference value (minimum value) and the judgment value (immediate stop accumulated pulses (minimum value)) is set.<br>The relation between this setting and the judgment value is as follows.<br><br>[If " Cd.17 Accumulated pulse setting value selection" is set to 0]<br><br>Immediate stop accumulated pulses (minimum value) = reference value (minimum value) + Cd.16 Immediate stop accumulated pulse setting value (minimum value)<br><br>[If " Cd.17 Accumulated pulse setting value selection" is set to 1]<br><br>Immediate stop accumulated pulses (minimum value) = reference value (minimum value) + ( Cd.16 Immediate stop accumulated pulse setting value (minimum value) - 1000) × reference value (minimum value) ÷ 1000<br><br>For details on the accumulated pulse error detection function, refer to the following.<br>☞ Page 221, Section 11.9 | • If " Cd.17 Accumulated pulse setting value selection" is set to 0: -148000 to -1 pulse<br>• If " Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000<br>(× $10^{-3}$: Last three digits are the value after the decimal point.) | 0 | 406<br>407 |
| Cd.17 | Accumulated pulse setting value selection | • The setting unit for " Cd.13 Alert output accumulated pulse setting value (maximum value)" to " Cd.16 Immediate stop accumulated pulse setting value (minimum value)" is selected.<br>• If a value other than 0 and 1 is set, the value is regarded as 0.<br>• If this area is set to 1 and the maximum/minimum reference values are set to 0, the error "Accumulated pulse error undetectable" (error code: 131) occurs and the accumulated pulse error detection function does not operate.<br><br>For details on the accumulated pulse error detection function, refer to the following.<br>☞ Page 221, Section 11.9 | 0: Set with pulse<br>1: Set with magnification | 0: Set with pulse | 408 |

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.18 | Accumulated pulse error detection request | • Use this area to start/stop the accumulated pulse error detection function.<br>• While this area is set to 1, the accumulated pulse error detection function is executed. However, if the reference value has never been measured, the error "Accumulated pulse error undetectable" (error code: 131) occurs and the function does not operate.<br>• If a value other than 0 and 1 is set, the value is regarded as 0.<br>• If " Cd.19 Measurement start request" is set to 1, the function does not operate even if this area is set to 1. (This request is ignored and after " Cd.19 Measurement start request" is set to 0, the function is executed.)<br><br>For details on the accumulated pulse error detection function, refer to the following.<br>Page 221, Section 11.9 | 0: No request<br>1: Requested | 0: No request | 409 |
| Cd.19 | Measurement start request | • Use this area to measure accumulated pulses used as the reference value to detect an error.<br>• While this area is set to 1, the maximum/minimum accumulated pulse values are measured.<br>• If a value other than 0 and 1 is set, the value is regarded as 0.<br>• If " Cd.18 Accumulated pulse error detection request" is set to 1, the value is not measured even if this area is set to 1. (This request is ignored and after " Cd.18 Accumulated pulse error detection request" is set to 0, the function is executed.)<br><br>For details on the accumulated pulse error detection function, refer to the following.<br>Page 221, Section 11.9 | 0: No request<br>1: Requested | 0: No request | 410 |

| Item | | Description | Setting range | Default value | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.20 | Reference value write request | • Use this area to save the measured reference value in the flash ROM of the QD73A1.<br>• When this area setting is changed to 1, the measured reference value is saved in the flash ROM.<br>• When " Md.20 Reference value measurement flag" is set to 1, the value is written to the flash ROM. If " Md.20 Reference value measurement flag" is set to the value other than 1, the error "Reference value write error" (error code: 132) occurs and the value is not written.<br>• The QD73A1 set this area to 0 when the value saving in the flash ROM is completed. This process is the same when an error occurs and the value is not written.<br><br>For details on the accumulated pulse error detection function, refer to the following.<br>☞ Page 221, Section 11.9 | 0: No request<br>1: Requested | 0: No request | 411 |

# CHAPTER 6 VARIOUS SETTINGS

This chapter describes setting procedures of the QD73A1.

**Point**

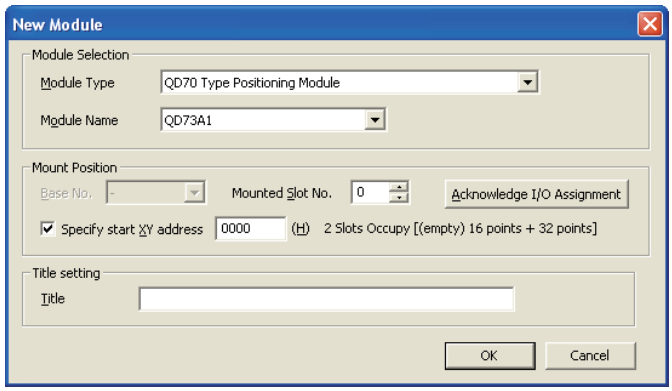
- After writing the contents of the new module, parameter settings, and auto refresh settings into the CPU module, reset the CPU module and switch its status as STOP → RUN → STOP → RUN, or turn off and on the power supply to activate the settings.
- After writing the contents of the switch settings, reset the CPU module or turn off and on the power supply to activate the settings.

## 6.1 Adding a Module

### (1) Addition procedure

Open the "New Module" window.

Project window⇨[Intelligent Function Module]⇨Right-click⇨[New Module...]




| Item | | Description |
|---|---|---|
| Module Selection | Module Type | Set "QD70 Type Positioning Module". |
| | Module Name | Set the name of the module to mount. |
| Mount Position | Base No. | Set the base unit where the module is mounted. |
| | Mounted Slot No. | Set the slot No. where the module is mounted. |
| | Specify start XY address | The start I/O number (hexadecimal) of the module is set, according to the mounted slot No. Any start I/O number can be set. |
| Title setting | Title | Set any title. |

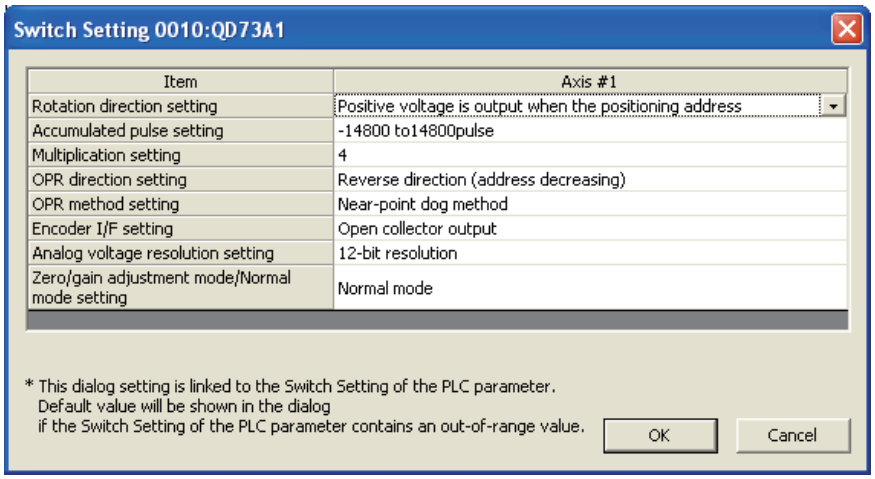
# 6.2 Switch Setting

Configure settings related to the drive unit and encoder that are connected to the QD73A1.

## (1) Setting method

Open the "Switch Setting" window.

Project window⇨[Intelligent Function Module]⇨Module name⇨[Switch Setting]




| Item | Description | Setting value | Default value | Reference |
|---|---|---|---|---|
| Rotation direction setting | Set the rotation direction in which positioning addresses increase. | • Positive voltage is output when the positioning address increases.<br>• Negative voltage is output when the positioning address increases. | Positive voltage is output when the positioning address increases. | Page 102, Section 6.2.1 |
| Accumulated pulse setting | Select the maximum accumulated pulse amount that can be counted in the deviation counter. | • -3700 to 3700 pulse [Selection 1]<br>• -7400 to 7400 pulse [Selection 2]<br>• -11100 to 11100 pulse [Selection 3]<br>• -14800 to 14800 pulse [Selection 4]<br>• -37000 to 37000 pulse [Selection 5]<br>• -74000 to 74000 pulse [Selection 6]<br>• -111000 to 111000 pulse [Selection 7]<br>• -148000 to 148000 pulse [Selection 8] | -14800 to 14800 pulse [Selection 4] | Page 102, Section 6.2.2 |
| Multiplication setting | Set the multiplication rate of feedback pulses from the pulse generator (PLG). | • 4<br>• 2<br>• 1<br>• 1/2 | 4 | Page 104, Section 6.2.3 |
| OPR direction setting | Set the direction in which OPR is executed. | • Reverse direction (address decreasing)<br>• Forward direction (address increasing) | Reverse direction (address decreasing) | Page 104, Section 6.2.4 |
| OPR method setting | Select an OPR method. | • Near-point dog method<br>• Count method | Near-point dog method | Page 104, Section 6.2.5 |
| Encoder I/F setting | Select an encoder output type from open collector, TTL, or differential output. | • Open collector output<br>• TTL output<br>• Differential output | Open collector output | Page 67, Section 4.6.2 |

| Item | Description | Setting value | Default value | Reference |
|---|---|---|---|---|
| Analog voltage resolution setting | Set resolution of analog voltage to be output as a speed command. | • 12-bit resolution<br>• 14-bit resolution<br>• 16-bit resolution | 12-bit resolution | Page 105, Section 6.2.7 |
| Zero/gain adjustment mode/Normal mode setting | Select the zero/gain adjustment mode or the normal mode. | • Normal mode<br>• Zero/gain adjustment mode | Normal mode | Page 63, Section 4.5 (4) (b) |

## 6.2.1 Rotation direction setting

Set the direction in which positioning addresses increase.
The rotation direction of a motor depends on the polarity of the voltage to be applied to the servo amplifier.
For details, refer to the manual for the servo amplifier.
For connection between the QD73A1 and an encoder, refer to the following.
☞Page 67, Section 4.6.2

## 6.2.2 Accumulated pulse setting

Select the maximum accumulated pulse amount that can be counted in the deviation counter.

### (1) Calculating accumulated pulse amount

When a servomotor is used, "maximum accumulated pulse amount" obtained by the following formula generates.

$$\text{Maximum accumulated pulse amount} = \frac{\text{Speed command (pulse/s)}}{\text{Position loop gain } (s^{-1})}$$

Configure this setting so that "maximum accumulated pulse amount" stays within the accumulated pulse setting range.

#### (a) Position loop gain

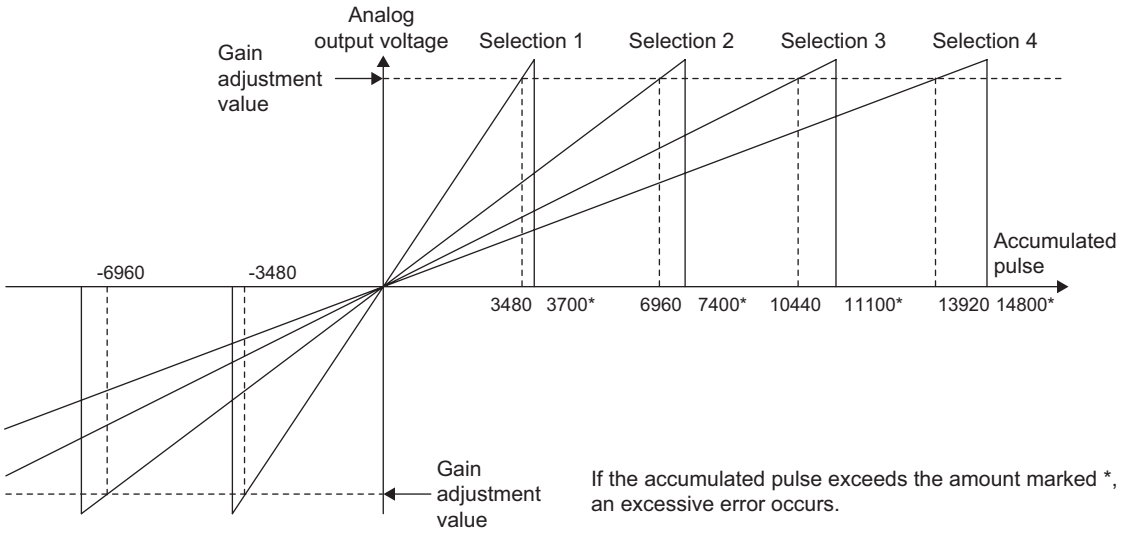
Position loop gain is a parameter to be set on the servomotor side. It effects operation in case of a servomotor stop and pulse amount in the deviation counter during operation.

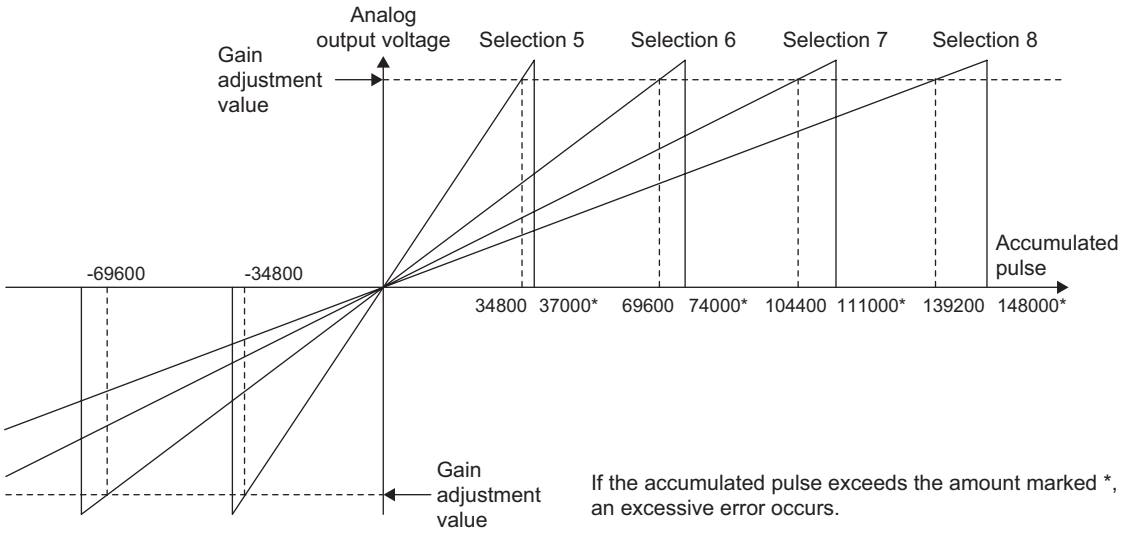
| Position loop gain value | Description |
|---|---|
| Low | Accumulated amount is large, and adjustment time at a stop becomes long. |
| High | Overshoot becomes large at a stop, or vibration tends to occur during a stop. |

Position loop gain is adjusted to 20 to 30$s^{-1}$ normally. Make fine adjustment if necessary.
For details, refer to the manual for the servomotor.

### (b) Accumulated pulse amount and analog output voltage from the QD73A1

The analog output voltage from the QD73A1 is controlled in proportion to accumulated pulse amount.




The following is an example of selecting an option in "Accumulated pulse setting".

**Ex.** Maximum speed: 4Mpulse/s, position loop gain: $30s^{-1}$

$$\text{Accumulated pulse} = \frac{\text{Maximum speed}}{\text{Position loop gain}} = \frac{4000000}{30} = 133333 \text{ pulses}$$

If the number of accumulated pulses is 133333, "-148000 to 148000 pulse" should be selected in "Accumulated pulse setting" so that analog output voltage will not be saturated.

### (2) Excessive error

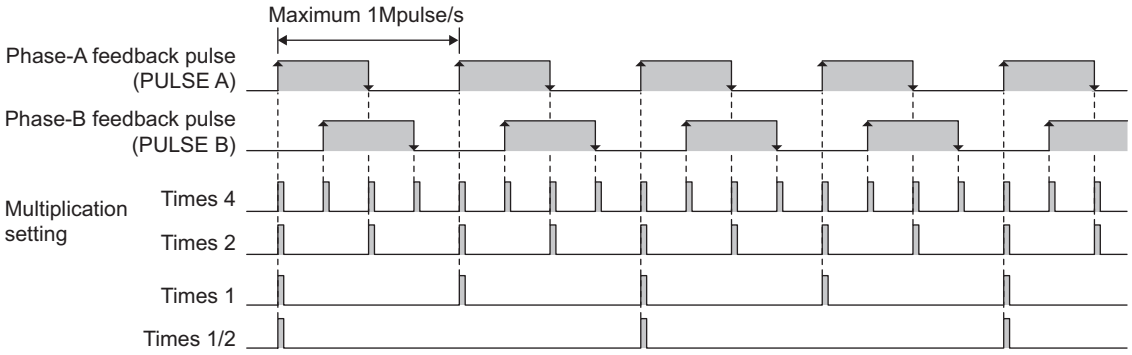
If accumulated pulse amount exceeds an upper limit value (values marked * in Page 103, Section 6.2.2 (1) (b)), an excessive error occurs and the following conditions occur in the system.

- Excessive error signal (X17): ON
- Analog output voltage: 0V
- Accumulated pulses: Reset to 0
- Servo ON signal (SVON): OFF

To reset an excessive error, turn off and on PLC READY signal (Y2D).

## 6.2.3 Multiplication setting

Set the multiplication rate of feedback pulses from the pulse generator (PLG).
This setting multiplies the feedback pulse count by 4, 2, 1, or 1/2. Use this setting to change movement amount per pulse by 1/4, 1/2, 1, or 2.




## 6.2.4 OPR direction setting

Set the direction in which OPR is executed.
For OPR control, refer to the following.
☞Page 176, CHAPTER 8

| Important |
| --- |
| OPR (Original Point Return) is controlled by two kinds of data: OPR direction and OPR speed. Deceleration starts when the near-point dog turns on. If an incorrect OPR direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the programmable controller. |

## 6.2.5 OPR method setting

Select an OPR method.
For OPR control, refer to the following.
☞Page 176, CHAPTER 8

## 6.2.6 Encoder I/F setting

Select an encoder output type from open collector, TTL, or differential output.

For connection between the QD73A1 and an encoder, refer to the following.

☞Page 67, Section 4.6.2

## 6.2.7 Analog voltage resolution setting

Set resolution of analog voltage to be output as a speed command.

**Point**

The default value of "Analog voltage resolution setting" is "12-bit resolution". When the analog voltage resolution of the connected drive unit is higher than 12 bits and the motor rotates even with a tiny voltage, the resolution can be set higher (14 bits or 16 bits). In that way, fine control can be achieved.

# 6.3 Parameter Setting

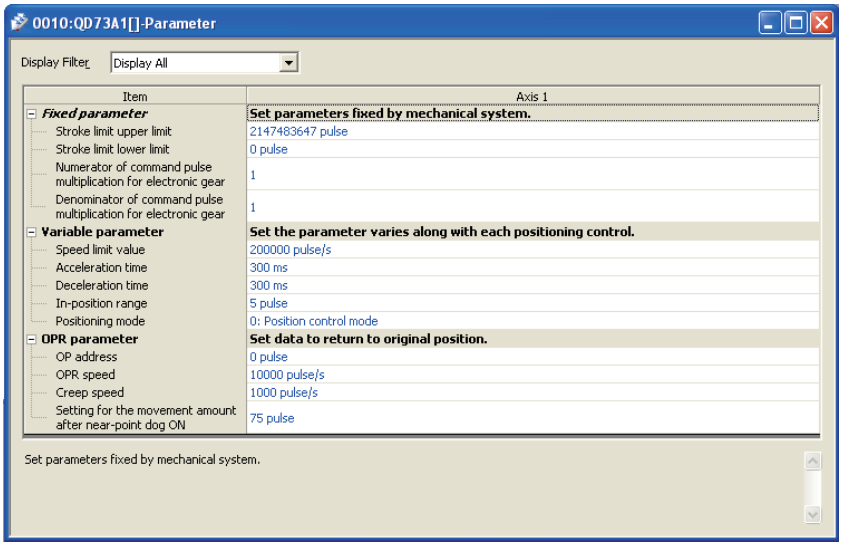
Set positioning parameters and OPR parameters.
Setting parameters on the screen omits the parameter setting in a sequence program.

## (1) Setting method

Open the "Parameter" window.

**1. Start "Parameter" in the project window.**

Project window⇨[Intelligent Function Module]⇨Module name⇨[Parameter]




**2. Double-click the item to change the setting, and input the setting value.**

- Items to input from the pull-down list
  For "Positioning mode", double-click the item to display the pull-down list. Select an option.
- Items to input from the textbox
  Double-click the item to set, and input the setting value.

For details on setting values, refer to the following.

| Setting item | | Default value | Reference |
|---|---|---|---|
| Fixed parameter | Stroke limit upper limit | 2147483647 pulse | Page 77, Section 5.2 (1) |
| | Stroke limit lower limit | 0 pulse | |
| | Numerator of command pulse multiplication for electronic gear | 1 | Page 78, Section 5.2 (2) |
| | Denominator of command pulse multiplication for electronic gear | 1 | |
| Variable parameter | Speed limit value | 200000 pulse/s | Page 78, Section 5.2 (3) |
| | Acceleration time | 300 ms | Page 79, Section 5.2 (4) |
| | Deceleration time | 300 ms | |
| | In-position range | 5 pulse | Page 79, Section 5.2 (5) |
| | Positioning mode | 0: Position control mode | Page 79, Section 5.2 (6) |
| OPR parameter | OP address | 0 pulse | Page 80, Section 5.3 (1) |
| | OPR speed | 10000 pulse/s | Page 80, Section 5.3 (2) |
| | Creep speed | 1000 pulse/s | Page 81, Section 5.3 (3) |
| | Setting for the movement amount after near-point dog ON | 75 pulse | Page 82, Section 5.3 (4) |

# 6.4 Positioning Data Setting

Set positioning data.

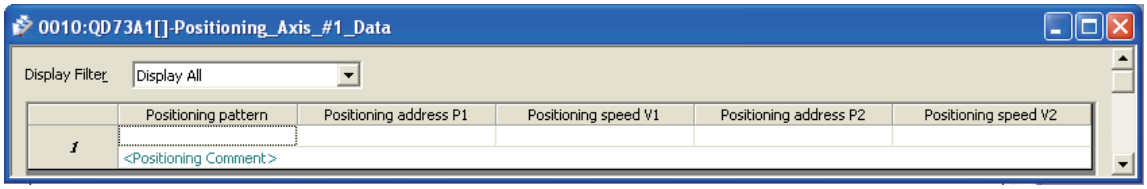
Setting positioning data on the screen omits the positioning data setting in a sequence program.

## (1) Setting method

Open the "Positioning_Axis_#1_Data" window.

**1. Start "Positioning_Axis_#1_Data" in the project window.**

Project window⇨[Intelligent Function Module]⇨Module name⇨[Positioning_Axis_#1_Data]




**2. Double-click "Positioning pattern", and set a positioning pattern.**

**3. Double -click items other than "Positioning pattern", and input setting values.**

For details on setting values, refer to the following.

| Setting item | Default value | Reference |
|---|---|---|
| Positioning pattern | None (empty) | Page 83, Section 5.4 (1) |
| Positioning address P1 | | Page 84, Section 5.4 (2) |
| Positioning speed V1 | | Page 85, Section 5.4 (3) |
| Positioning address P2 | | Page 85, Section 5.4 (4) |
| Positioning speed V2 | | Page 85, Section 5.4 (5) |

# 6.5 Auto Refresh

This function transfers data in the buffer memory to specified devices.
The auto refresh setting omits data reading/writing through a program.

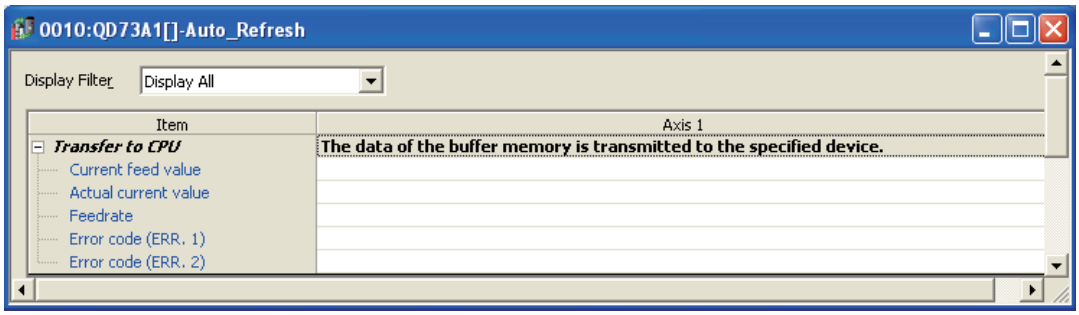
## (1) Setting method

Open the "Auto_Refresh" window.

**1. Start "Auto_Refresh" in the project window.**

Project window⇨[Intelligent Function Module]⇨Module name ⇨[Auto_Refresh]

**2. Click the item to set, and input the destination device for auto refresh.**



# CHAPTER 7 PROGRAMMING

This chapter describes sequence programs of the QD73A1.
When applying the program examples introduced in this chapter to the actual system, ensure the applicability and confirm that they will not cause system control problems.

## 7.1 Precautions on Programming

### (1) At power-on and operation start

At a power-on or operation start, execute OPR to confirm the original point (OP). When an OPR request is issued, take the OPR into consideration.

### (2) Near-point dog signal

Use a high-performance near-point dog signal. If Near-point dog signal is not input upon OPR, the workpiece continues to move at the OPR speed.

### (3) Measures against an overrun

By setting a stroke limit upper limit and lower limit of the QD73A1, an overrun can be prevented.
Note that this is only when the QD73A1 is operating normally. Set limit switches "upper limit switch" and "lower limit switch" to ensure the safety of the entire system. It is recommended to establish an external circuit through which the motor's power turns off when a limit switch turns on.

### (4) Stroke limit upper limit value/lower limit value

Check that proper values are set in "Pr.1 Stroke limit upper limit" and "Pr.2 Stroke limit lower limit".

### (5) Emergency stop signal

Establish an emergency stop circuit outside the programmable controllers.

### (6) When errors are checked in a sequence program

Turn off PLC READY signal (Y2D) at error detection.

### (7) Pr.5 Speed limit value

Check that a proper value is set.

### (8) Cd.3 JOG speed

Do not set a large value at the beginning; start operation at lower speed.

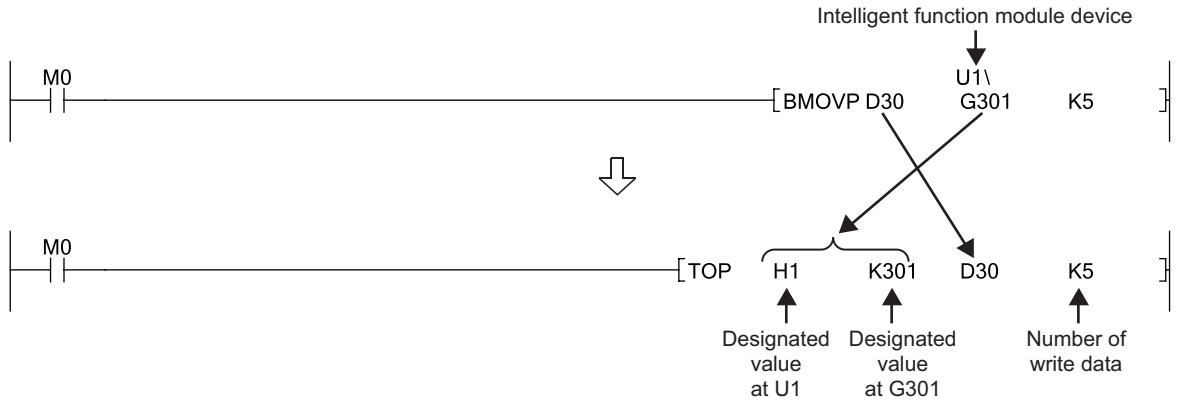
## (9) Communication with the QD73A1

There are following ways of communication with the QD73A1 using a sequence program.

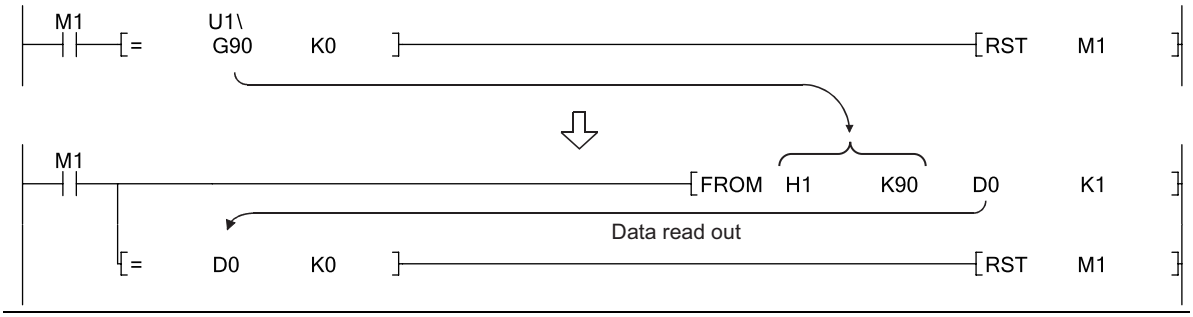
- Communication using intelligent function module devices
- Communication using the FROM/TO instruction

The sequence programs introduced in this chapter uses intelligent function module devices. When using the FROM/TO instruction, change the sequence program as shown below.

When an intelligent function module device is used as the destination side in a circuit using the BMOVP instruction, change the instruction to the TOP instruction.




When an intelligent function module device is used in a circuit using a comparison instruction, change the instruction to the FROM instruction and a comparison instruction.




For intelligent function module devices, refer to the following.

The user's manual (Function Explanation, Program Fundamentals) for the CPU module used.

For details on the instructions used in programs in this chapter, refer to the following.

MELSEC-Q/L Programming Manual (Common Instruction)

## (10)I/O number assignment for the QD73A1

The QD73A1 occupies 48 I/O points of 2 slots.

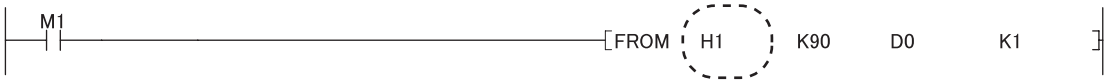
### (a) Default I/O number assignment

Set the first half to "Empty 16 points" and the second half to "Intelligent 32 points" in GX Works2.

I/O Assignment(*1)

| No. | Slot | Type | Model Name | Points | Start XY |
|---|---|---|---|---|---|
| 0 | PLC | PLC | | | |
| 1 | 0(*-0) | Empty | 2 Slots Occupy | 16Points | 0000 |
| 2 | 1(*-1) | Intelligent | QD73A1 | 32Points | 0010 |

When executing the FROM/TO instruction on the QD73A1, use the I/O number assigned to the second half (slot) of the QD73A1.




### (b) When the first half (slot) is "Empty 0 point"

At the I/O assignment in GX Works2, the 16 points in the first half can be saved by setting the first half to "Empty 0 point".

I/O Assignment(*1)

| No. | Slot | Type | Model Name | Points | Start XY |
|---|---|---|---|---|---|
| 0 | PLC | PLC | | | |
| 1 | 0(*-0) | Empty | 2 Slots Occupy | 0 Point | |
| 2 | 1(*-1) | Intelligent | QD73A1 | 32Points | 0000 |

When executing the FROM/TO instruction on the QD73A1, use the I/O number assigned to the second half (slot) of the QD73A1.

# 7.2 Programs for Positioning

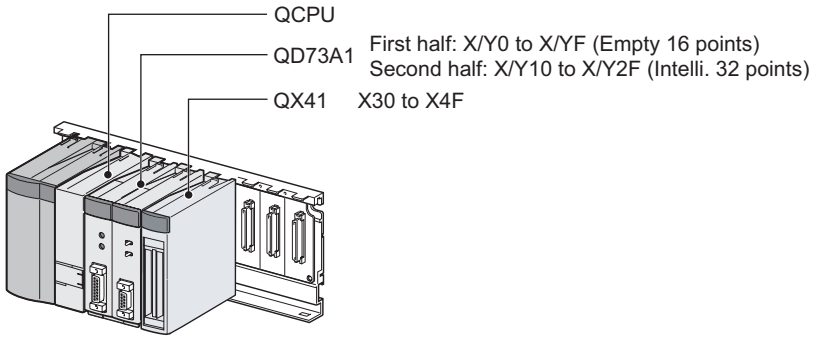
Follow the procedure below when creating programs that execute positioning using the QD73A1.

| Procedure | Program | Reference |
|---|---|---|
| 1 | Parameter setting<br>Create a program for parameter setting. | Page 115, Section 7.3.1<br>Page 147, Section 7.4.1 |
| 2 | OPR<br>Create a program for one of the following.<br>• Near-point dog method<br>• Count method | Page 117, Section 7.3.2<br>Page 149, Section 7.4.2 |
| 3 | Start program<br>Create programs for the following depending on the control to be executed.<br>• Positioning control<br>• Two-phase trapezoidal positioning control<br>• Speed-position control switch mode<br>• Speed control operation<br>• Fixed-feed operation<br>• JOG operation | Page 123, Section 7.3.3<br>Page 131, Section 7.3.4<br>Page 133, Section 7.3.5<br>Page 155, Section 7.4.3<br>Page 165, Section 7.4.4<br>Page 168, Section 7.4.5 |
| 4 | Sub program<br>Create programs for the following depending on the control to be executed.<br>• Current value change<br>• Speed change<br>• Deviation counter clear | Page 135, Section 7.3.6<br>Page 170, Section 7.4.6 |
| 5 | Stop program<br>Create a program for stopping control. | Page 139, Section 7.3.7<br>Page 175, Section 7.4.7 |

# 7.3 When Using the Module in a Standard System Configuration

This section introduces program examples where the following system configuration applies.

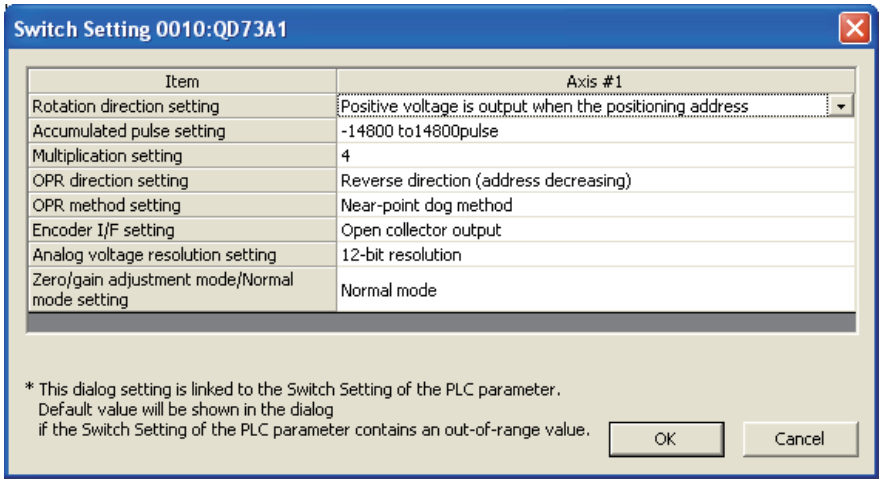
## (1) System configuration




## (2) Switch setting

Configure the switch setting as follows.

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]

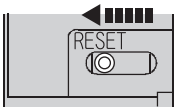



| Item | Setting value |
|---|---|
| Rotation direction setting | Set this item according to the system to be used. |
| Accumulated pulse setting | Set this item according to the system to be used. |
| Multiplication setting | Set this item according to the system to be used. |
| OPR direction setting | Set this item according to the system to be used. |
| OPR method setting | Set the near-point dog method or the count method. |
| Encoder I/F setting | Set this item according to the system to be used. |
| Analog voltage resolution setting | Set this item according to the system to be used. |
| Zero/gain adjustment mode/Normal mode setting | Set "Normal mode". |

### (3) Writing parameters

Write the set parameters to the CPU module, then reset the CPU module or turn off and on the power supply of the programmable controller.

[Online]⇨[Write to PLC...]




or Power off → on

### (4) I/O signals of the QD73A1

Refer to Page 31, Section 3.4.1. I/O signals used in program examples are assigned as in the list on Page 31, Section 3.4.1.

### (5) Program example

Refer to the following.

| Program example | Reference |
|---|---|
| Parameter setting program | Page 115, Section 7.3.1 |
| Near-point dog method OPR program | Page 117, Section 7.3.2 (1) |
| Count method OPR program | Page 120, Section 7.3.2 (2) |
| Positioning control program | Page 123, Section 7.3.3 (1) |
| Two-phase trapezoidal positioning control program | Page 125, Section 7.3.3 (2) |
| Speed-position control switch mode program | Page 127, Section 7.3.3 (3) |
| Speed control operation program | Page 129, Section 7.3.3 (4) |
| Fixed-feed operation program | Page 131, Section 7.3.4 |
| JOG operation program | Page 133, Section 7.3.5 |
| Current value change program | Page 135, Section 7.3.6 (1) |
| Speed change program | Page 136, Section 7.3.6 (2) |
| Deviation counter clearing program | Page 138, Section 7.3.6 (3) |
| Stop program during positioning | Page 139, Section 7.3.7 |

# 7.3.1 Parameter setting program

This program sets fixed parameters and variable parameters.

**Point**

Parameters described in this section can be set through GX Works2 also. (Page 106, Section 6.3)
The sequence program in this section is unnecessary when the parameters were set through GX Works2.

## (1) Program detail

- The following fixed parameters are set once the CPU module is in the RUN status.

| Item | Setting detail |
|---|---|
| Pr.1 Stroke limit upper limit | 20000000pulse |
| Pr.2 Stroke limit lower limit | 0pulse |
| Pr.3 Numerator of command pulse multiplication for electronic gear | 1 |
| Pr.4 Denominator of command pulse multiplication for electronic gear | 1 |

- As X30 is turned on, the following variable parameters are set.

| Item | Setting detail |
|---|---|
| Pr.5 Speed limit value | 30000pulse |
| Pr.6 Acceleration time | 400ms |
| Pr.7 Deceleration time | 250ms |
| Pr.8 In-position range | 10pulse |
| Pr.9 Positioning mode | 0: Position control mode |

## (2) Execution condition

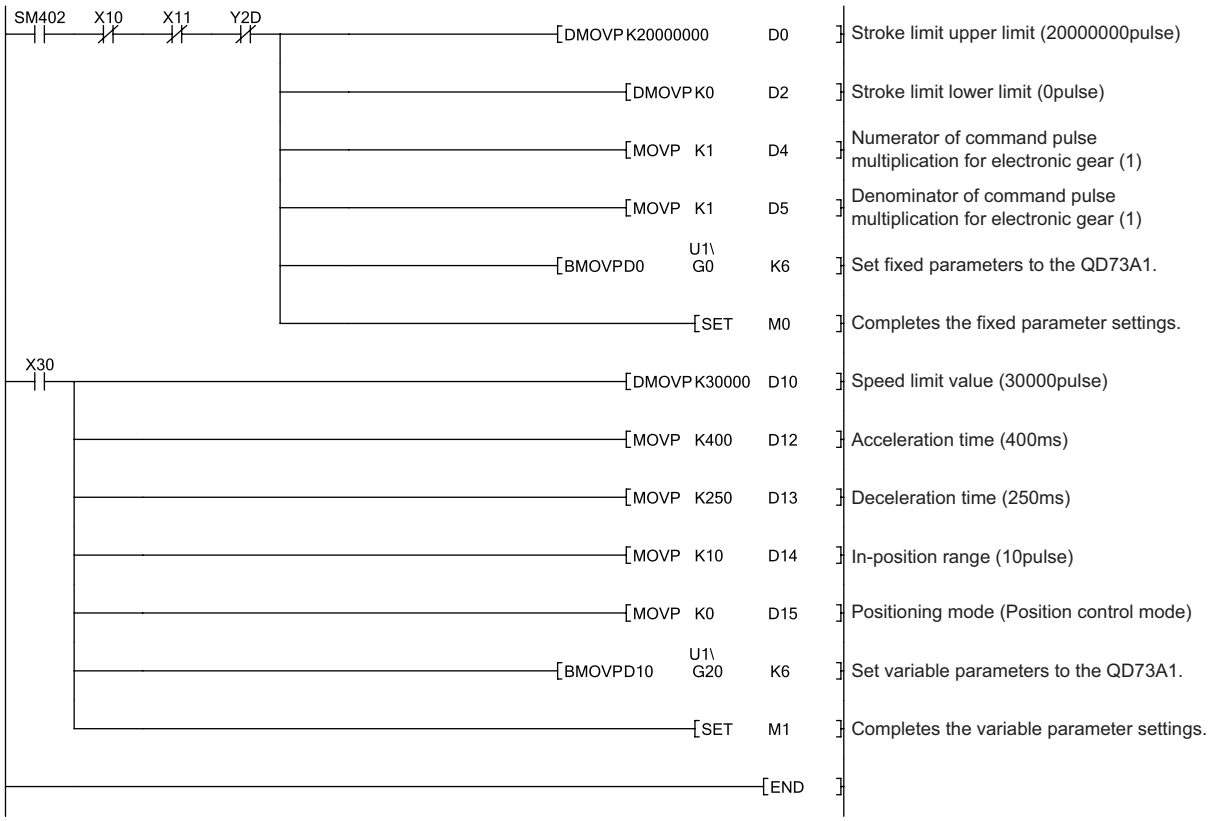
| Check item | | Condition |
|---|---|---|
| I/O signal | WDT error, H/W error signal (X10) | OFF |
| | QD73A1 READY signal (X11) | OFF |
| | PLC READY signal (Y2D) | OFF |

## (3) Device used by the user

| Device | Description |
|---|---|
| X30 | Variable parameter setting command |
| D0 | Stroke limit upper limit (lower 16 bits) |
| D1 | Stroke limit upper limit (upper 16 bits) |
| D2 | Stroke limit lower limit (lower 16 bits) |
| D3 | Stroke limit lower limit (upper 16 bits) |
| D4 | Numerator of command pulse multiplication for electronic gear |
| D5 | Denominator of command pulse multiplication for electronic gear |
| D10 | Speed limit value (lower 16 bits) |
| D11 | Speed limit value (upper 16 bits) |

| Device | Description |
|---|---|
| D12 | Acceleration time |
| D13 | Deceleration time |
| D14 | In-position range |
| D15 | Positioning mode |
| M0 | Fixed parameter setting memory |
| M1 | Variable parameter setting memory |
| SM402 | Turns on for one scan once the CPU module is in the RUN status |

## (4) Program example



# 7.3.2 OPR program

Programs in this section execute OPR in the near-point dog method or the count method.

## (1) Near-point dog method OPR program

This program executes OPR in the near-point dog method. Suppose that fixed parameters and variable parameters are already set. (☞Page 115, Section 7.3.1)

### (a) Program detail

- The following OPR parameters are written once the CPU module is in the RUN status, and PLC READY signal (Y2D) turns on.

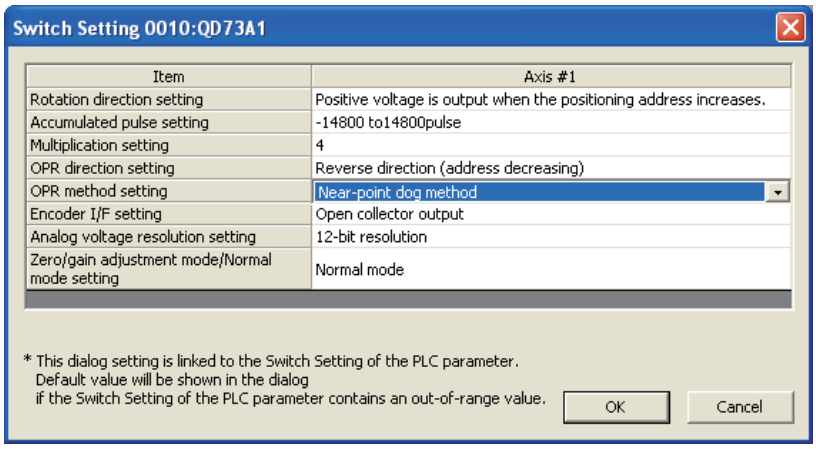
| Item | Setting detail |
|---|---|
| Pr.10 OP address | 100pulse |
| Pr.11 OPR speed | 5000pulse/s |
| Pr.12 Creep speed | 500pulse/s |

- As X31 is turned on after PLC READY signal (Y2D) turned on, the module executes OPR.

### (b) Switch setting

Before executing the program, set "Near-point dog method" to "OPR method setting".

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]



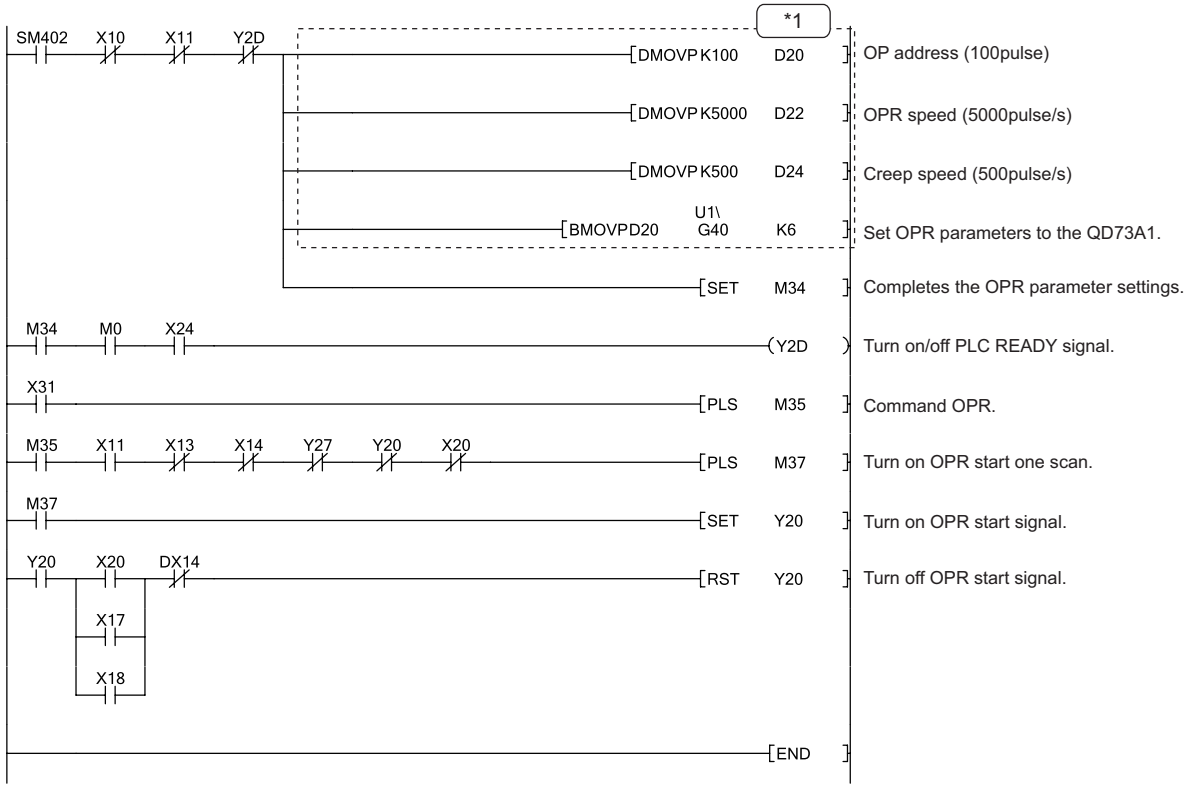
### (c) Execution condition

| Check item | | Condition |
|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON |
| | Stop signal (STOP) | OFF |
| | Upper limit signal (FLS) | ON |
| | Lower limit signal (RLS) | ON |
| | Near-point dog signal (DOG) | OFF |
| I/O signal | WDT error, H/W error signal (X10) | OFF |
| | QD73A1 READY signal (X11) | OFF |
| | OPR complete signal (X13) | OFF |
| | BUSY signal (X14) | OFF |
| | Excessive error signal (X17) | OFF |
| | Error detection signal (X18) | OFF |
| | OPR start complete signal (X20) | OFF |
| | Synchronization flag (X24) | ON |
| | OPR start signal (Y20) | OFF |
| | Stop signal (Y27) | OFF |
| | PLC READY signal (Y2D) | OFF |
| Buffer memory | OPR parameters | No error |

### (d) Device used by the user

| Device | Description |
|---|---|
| X31 | OPR command |
| D20 | OP address (lower 16 bits) |
| D21 | OP address (upper 16 bits) |
| D22 | OPR speed (lower 16 bits) |
| D23 | OPR speed (upper 16 bits) |
| D24 | Creep speed (lower 16 bits) |
| D25 | Creep speed (upper 16 bits) |
| M0 | Fixed parameter setting memory |
| M34 | OPR parameter setting memory |
| M35 | OPR request |
| M37 | OPR command pulse |
| SM402 | Turns on for one scan once the CPU module is in the RUN status |

### (e) Program example




*1 OPR parameters can be set through GX Works2 also. (☞ Page 106, Section 6.3)
The sequence program that sets OPR parameters is unnecessary when the parameters were set through GX Works2.

## (2) Count method OPR program

This program executes OPR in the count method. Suppose that fixed parameters and variable parameters are already set. (Page 115, Section 7.3.1)

### (a) Program detail

- The following OPR parameters are written once the CPU module is in the RUN status, and PLC READY signal (Y2D) turns on.

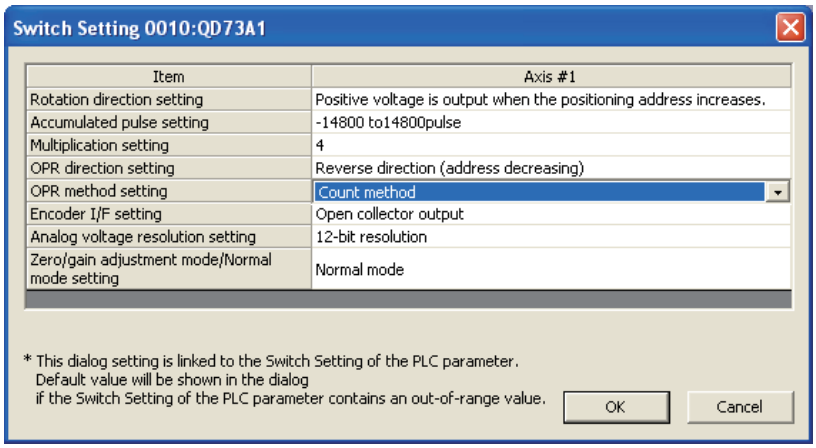
| Item | Setting detail |
|---|---|
| Pr.10 OP address | 100pulse |
| Pr.11 OPR speed | 5000pulse/s |
| Pr.12 Creep speed | 500pulse/s |
| Pr.13 Setting for the movement amount after near-point dog ON | 2000pulse |

- As X31 is turned on after PLC READY signal (Y2D) turned on, the module executes OPR.

### (b) Switch setting

Before executing the program, set "Count method" to "OPR method setting".

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]



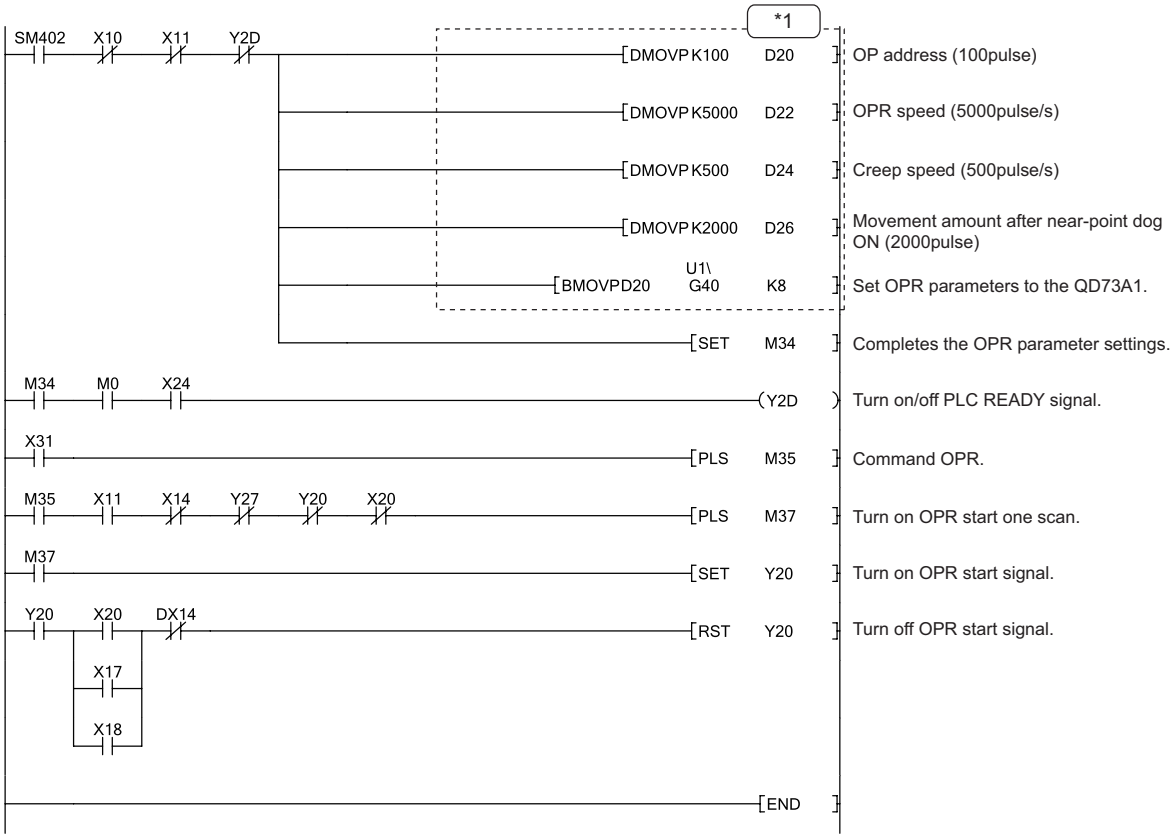
### (c) Execution condition

| Check item | | Condition |
|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON |
| | Stop signal (STOP) | OFF |
| | Upper limit signal (FLS) | ON |
| | Lower limit signal (RLS) | ON |
| I/O signal | WDT error, H/W error signal (X10) | OFF |
| | QD73A1 READY signal (X11) | OFF |
| | BUSY signal (X14) | OFF |
| | Excessive error signal (X17) | OFF |
| | Error detection signal (X18) | OFF |
| | OPR start complete signal (X20) | OFF |
| | Synchronization flag (X24) | ON |
| | OPR start signal (Y20) | OFF |
| | Stop signal (Y27) | OFF |
| | PLC READY signal (Y2D) | OFF |
| Buffer memory | OPR parameters | No error |

### (d) Device used by the user

| Device | Description |
|---|---|
| X31 | OPR command |
| D20 | OP address (lower 16 bits) |
| D21 | OP address (upper 16 bits) |
| D22 | OPR speed (lower 16 bits) |
| D23 | OPR speed (upper 16 bits) |
| D24 | Creep speed (lower 16 bits) |
| D25 | Creep speed (upper 16 bits) |
| D26 | Movement amount after near-point dog ON (lower 16 bits) |
| D27 | Movement amount after near-point dog ON (upper 16 bits) |
| M0 | Fixed parameter setting memory |
| M34 | OPR parameter setting memory |
| M35 | OPR request |
| M37 | OPR command pulse |
| SM402 | Turns on for one scan once the CPU module is in the RUN status |

### (e) Program example




*1 OPR parameters can be set through GX Works2 also. (☞Page 106, Section 6.3)
The sequence program that sets OPR parameters is unnecessary when the parameters were set through GX Works2.

# 7.3.3 Major positioning control program

Programs in this section execute major positioning control.

## (1) Positioning control program

This program executes positioning control in the absolute system. Suppose that the parameter setting and OPR were completed. (☞Page 115, Section 7.3.1, Page 117, Section 7.3.2)

### (a) Program detail

- As X33 is turned on, the following positioning data are written.

| Item | Setting detail |
|---|---|
| Da.1 Positioning pattern | 0: Positioning control |
| Da.2 Positioning address P1 | 100000pulse |
| Da.3 Positioning speed V1 | 10000pulse/s |

- As X34 is turned on, the module executes positioning control in the absolute system.

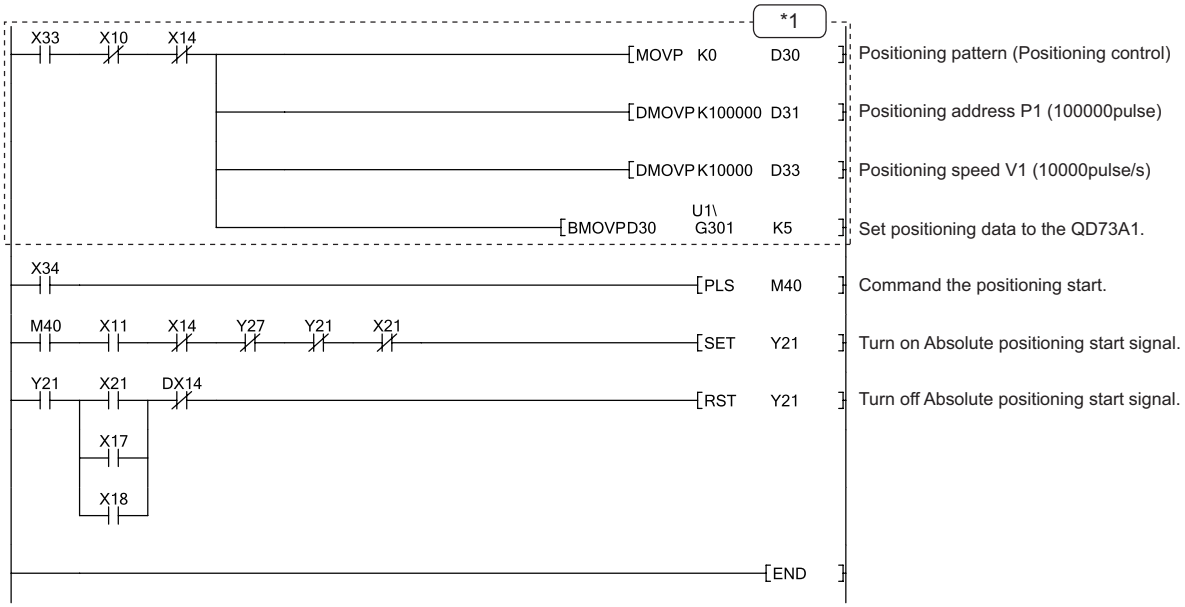
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | WDT error, H/W error signal (X10) | OFF | — |
| | QD73A1 READY signal (X11) | ON | |
| | BUSY signal (X14) | OFF | |
| | Excessive error signal (X17) | OFF | |
| | Error detection signal (X18) | OFF | |
| | Absolute positioning start complete signal (X21) | OFF | |
| | Synchronization flag (X24) | ON | |
| | Absolute positioning start signal (Y21) | OFF | |
| | Stop signal (Y27) | OFF | |
| | PLC READY signal (Y2D) | ON | |
| Buffer memory | Positioning data | No error | When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value". |

### (c) Device used by the user

| Device | Description |
|---|---|
| X33 | Positioning data write command |
| X34 | Positioning start command |
| D30 | Positioning pattern |
| D31 | Positioning address P1 (lower 16 bits) |
| D32 | Positioning address P1 (upper 16 bits) |
| D33 | Positioning speed V1 (lower 16 bits) |
| D34 | Positioning speed V1 (upper 16 bits) |
| M40 | Positioning start command pulse |

### (d) Program example




*1 Positioning data can be set through GX Works2 also. (☞ Page 107, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

## (2) Two-phase trapezoidal positioning control program

This program executes two-phase trapezoidal positioning control in the absolute system. Suppose that the parameter setting and OPR were completed. (☞Page 115, Section 7.3.1, Page 117, Section 7.3.2)

### (a) Program detail

- As X35 is turned on, the following positioning data are written.

| Item | Setting detail |
|---|---|
| Da.1 Positioning pattern | 1: Two-phase trapezoidal positioning control |
| Da.2 Positioning address P1 | 100000pulse |
| Da.3 Positioning speed V1 | 10000pulse/s |
| Da.4 Positioning address P2 | 150000pulse |
| Da.5 Positioning speed V2 | 12000pulse/s |

- As X36 is turned on, the module executes two-phase trapezoidal positioning control in the absolute system.

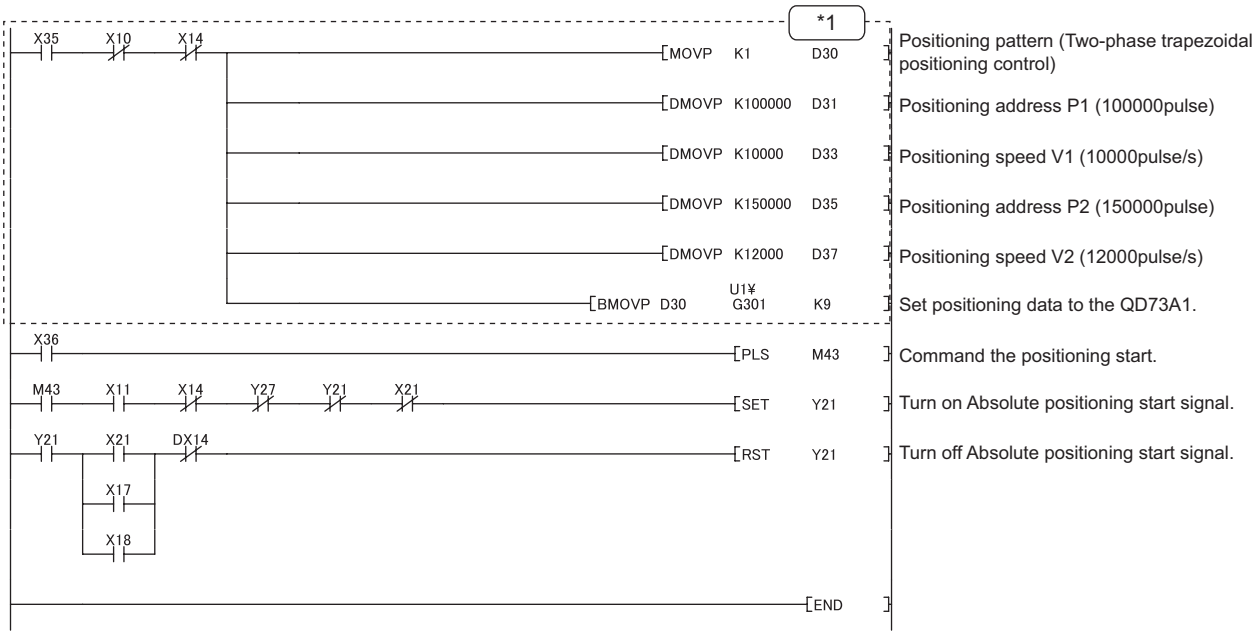
### (b) Execution condition

The execution condition is the same as that of positioning control program. (☞Page 123, Section 7.3.3 (1) (b))

### (c) Device used by the user

| Device | Description |
|---|---|
| X35 | Positioning data write command |
| X36 | Two-phase trapezoidal positioning control start command |
| D30 | Positioning pattern |
| D31 | Positioning address P1 (lower 16 bits) |
| D32 | Positioning address P1 (upper 16 bits) |
| D33 | Positioning speed V1 (lower 16 bits) |
| D34 | Positioning speed V1 (upper 16 bits) |
| D35 | Positioning address P2 (lower 16 bits) |
| D36 | Positioning address P2 (upper 16 bits) |
| D37 | Positioning speed V2 (lower 16 bits) |
| D38 | Positioning speed V2 (upper 16 bits) |
| M43 | Two-phase trapezoidal positioning control start command pulse |

### (d) Program example




*1 Positioning data can be set through GX Works2 also. (☞ Page 107, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

## (3) Speed-position control switch mode program

This program switches the positioning mode to the "speed-position control switch mode". Suppose that the parameter setting and OPR were completed. (☞Page 115, Section 7.3.1, Page 117, Section 7.3.2)

### (a) Program detail

- As X37 is turned on, the positioning mode is set to "speed-position control switch mode".
- As X38 is turned on, the following positioning data are written.

| Item | Setting detail |
|---|---|
| Da.2 Positioning address P1 | 5000pulse |
| Da.3 Positioning speed V1 | 1000pulse/s |

- As X39 is turned on, the module starts speed control. The module switches the operation to position control following an external control switch command.
- As X3B is turned on, the module restarts operation in case that the operation was stopped following a stop signal input.

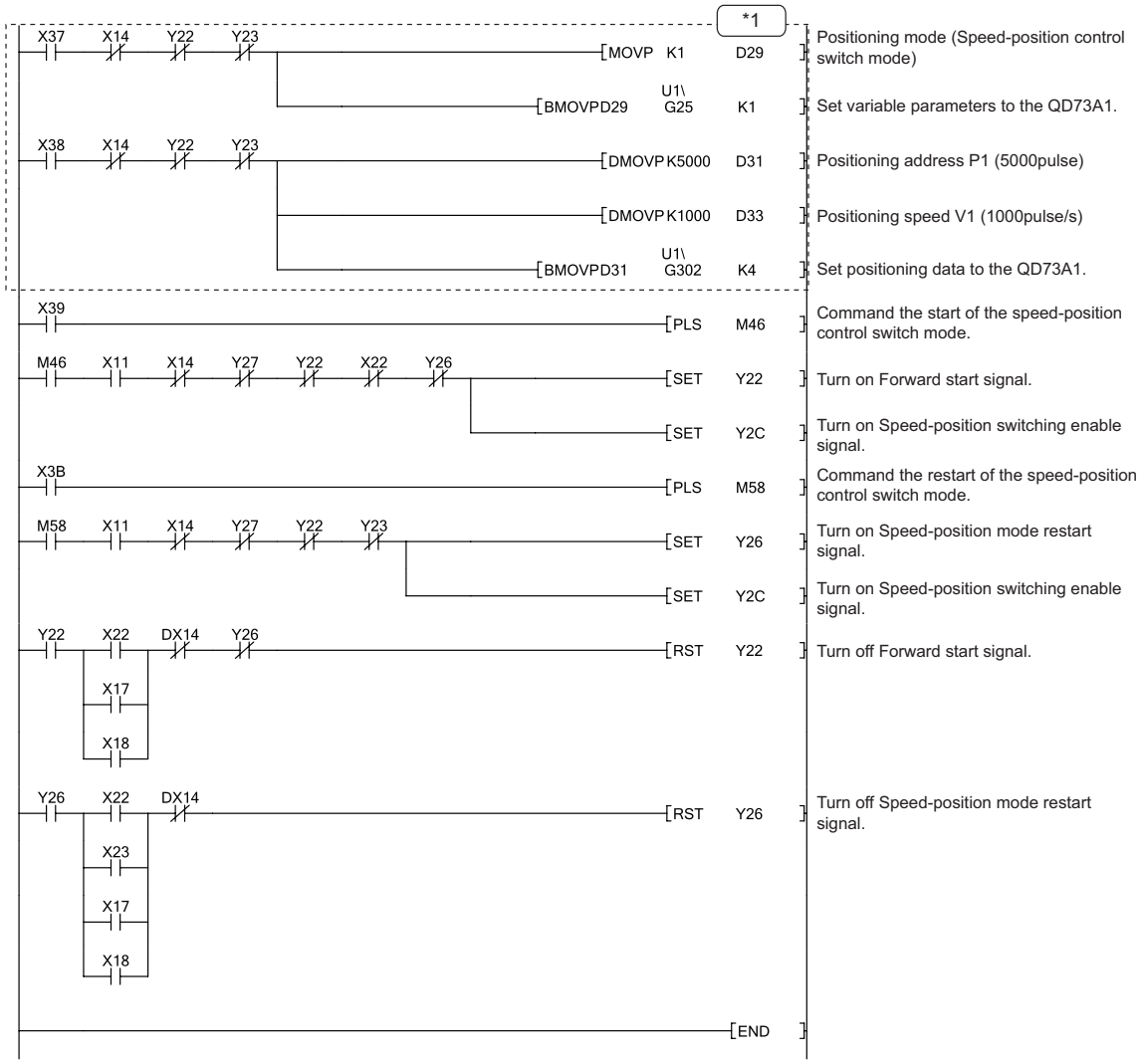
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | QD73A1 READY signal (X11) | ON | — |
| | BUSY signal (X14) | OFF | |
| | Excessive error signal (X17) | OFF | |
| | Error detection signal (X18) | OFF | |
| | Forward start complete signal (X22) | OFF | |
| | Synchronization flag (X24) | ON | |
| | Forward start signal (Y22) | OFF | |
| | Reverse start signal (Y23) | OFF | |
| | Speed-position mode restart signal (Y26) | OFF | |
| | Stop signal (Y27) | OFF | |
| | Speed-position switching enable signal (Y2C) | OFF | |
| | PLC READY signal (Y2D) | ON | |
| Buffer memory | Positioning data | No error | When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value". |

### (c) Device used by the user

| Device | Description |
|---|---|
| X37 | Variable parameter change command |
| X38 | Positioning data write command |
| X39 | Speed-position control positioning start command |
| X3B | Speed-position control positioning restart command |
| D29 | Positioning mode |
| D31 | Positioning address P1 (lower 16 bits) |
| D32 | Positioning address P1 (upper 16 bits) |
| D33 | Positioning speed V1 (lower 16 bits) |
| D34 | Positioning speed V1 (upper 16 bits) |
| M46 | Speed-position control positioning start command pulse |
| M58 | Speed-position control positioning restart command pulse |

### (d) Program example


*1
X37 X14 Y22 Y23 MOVP K1 D29
Positioning mode (Speed-position control switch mode)
BMOVP D29 U1\G25 K1
Set variable parameters to the QD73A1.
X38 X14 Y22 Y23 DMOVP K5000 D31
Positioning address P1 (5000pulse)
DMOVP K1000 D33
Positioning speed V1 (1000pulse/s)
BMOVP D31 U1\G302 K4
Set positioning data to the QD73A1.
X39 PLS M46
Command the start of the speed-position control switch mode.
M46 X11 X14 Y27 Y22 X22 Y26 SET Y22
Turn on Forward start signal.
SET Y2C
Turn on Speed-position switching enable signal.
X3B PLS M58
Command the restart of the speed-position control switch mode.
M58 X11 X14 Y27 Y22 Y23 SET Y26
Turn on Speed-position mode restart signal.
SET Y2C
Turn on Speed-position switching enable signal.
Y22 X22 DX14 Y26 RST Y22
Turn off Forward start signal.
X17
X18
Y26 X22 DX14 RST Y26
Turn off Speed-position mode restart signal.
X23
X17
X18
END

*1 Variable parameters and positioning data can be set through GX Works2 also. (Page 106, Section 6.3, Page 107, Section 6.4)
The sequence program that sets variable parameters and positioning data is unnecessary when the data were set through GX Works2.

## (4) Speed control operation program

This program executes speed control using the speed control function of the speed-position control switch mode. Suppose that parameters are already set. (☞Page 115, Section 7.3.1)

### (a) Program detail

- As X3C is turned on, the positioning mode is set to "speed-position control switch mode".
- As X3D is turned on, the following positioning data is written.

| Item | Setting detail |
|---|---|
| Da.3 Positioning speed V1 | 1000pulse/s |

- As X3E is turned on, the module starts speed control of forward run. As X3F is turned on, the module starts speed control of reverse run.

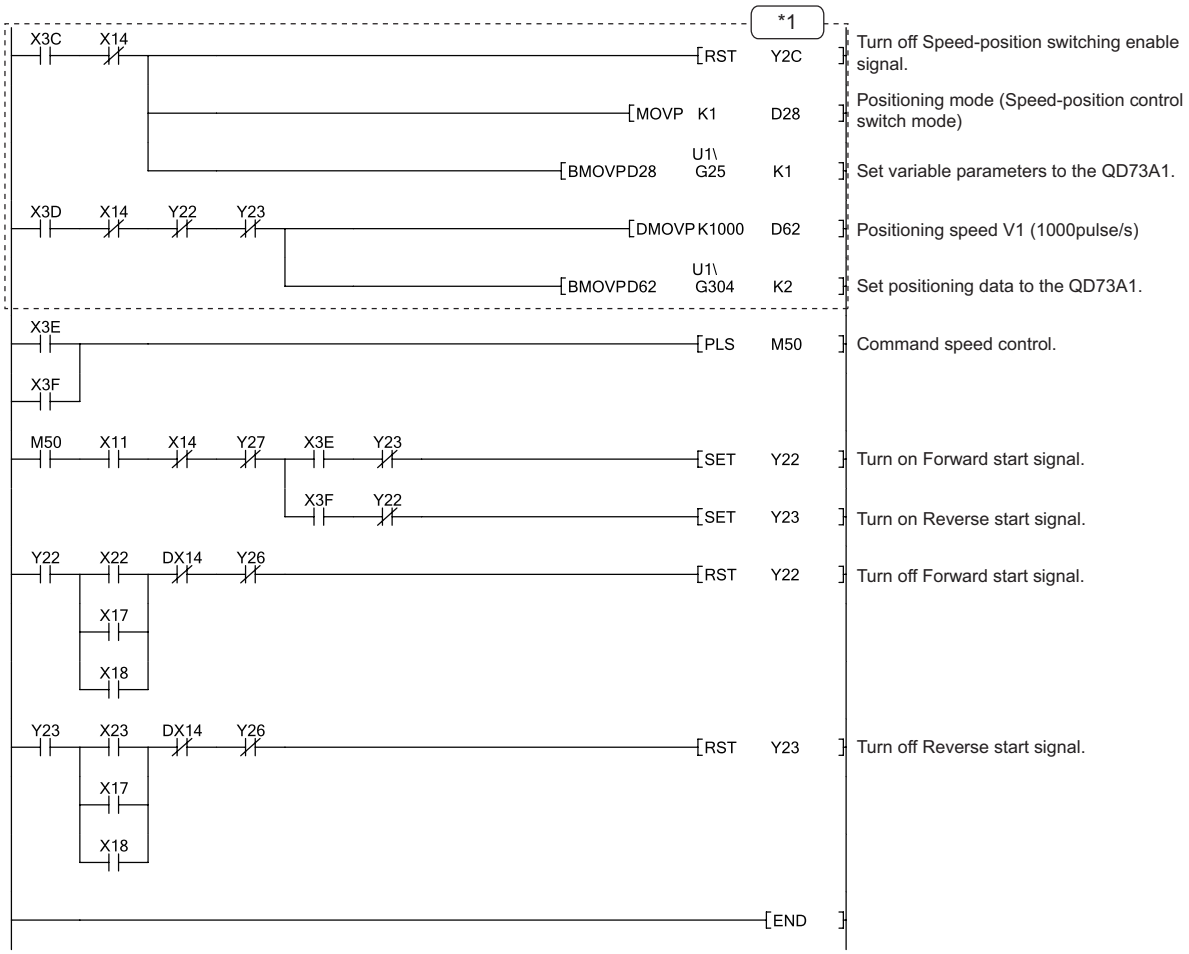
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | QD73A1 READY signal (X11) | ON | — |
| | BUSY signal (X14) | OFF | |
| | Excessive error signal (X17) | OFF | |
| | Error detection signal (X18) | OFF | |
| | Forward start complete signal (X22) | OFF | |
| | Reverse start complete signal (X23) | OFF | |
| | Synchronization flag (X24) | ON | |
| | Forward start signal (Y22) | OFF | |
| | Reverse start signal (Y23) | OFF | |
| | Speed-position mode restart signal (Y26) | OFF | |
| | Stop signal (Y27) | OFF | |
| | Speed-position switching enable signal (Y2C) | OFF | |
| | PLC READY signal (Y2D) | ON | |
| Buffer memory | Positioning data | No error | When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value". |

### (c) Device used by the user

| Device | Description |
|---|---|
| X3C | Speed control operation change command |
| X3D | Positioning data write command |
| X3E | Forward run command |
| X3F | Reverse run command |
| D28 | Positioning mode |
| D62 | Positioning speed V1 (lower 16 bits) |
| D63 | Positioning speed V1 (upper 16 bits) |
| M50 | Speed control command pulse |

### (d) Program example




*1 Variable parameters and positioning data can be set through GX Works2 also. (☞ Page 106, Section 6.3, Page 107, Section 6.4)
The sequence program that sets variable parameters and positioning data is unnecessary when the data were set through GX Works2.

# 7.3.4 Fixed-feed operation program

This program executes positioning in the address increasing direction according to the specified movement amount and speed. Execute fixed-feed operation by turning on Fixed-feed start command repeatedly. Use the current value change function and positioning start in the absolute system. Suppose that parameter setting and OPR were completed. (Page 115, Section 7.3.1, Page 117, Section 7.3.2)

## (1) Program detail

- As X40 is turned on, the following positioning data are written.

| Item | Setting detail |
|---|---|
| Da.2 Positioning address P1 | 20000pulse |
| Da.3 Positioning speed V1 | 1000pulse/s |

- As X41 is turned on, the module starts fixed-feed operation.

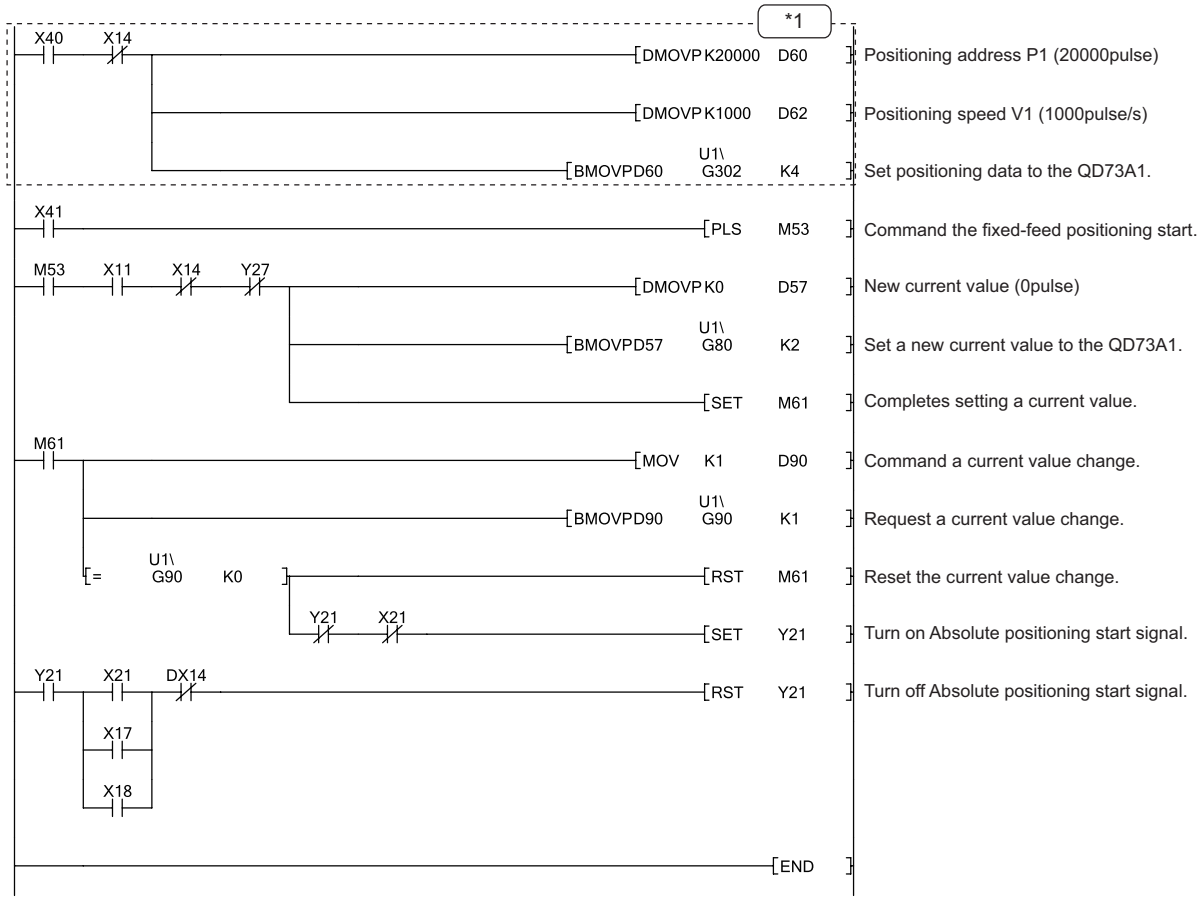
## (2) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | QD73A1 READY signal (X11) | ON | — |
| | BUSY signal (X14) | OFF | |
| | Excessive error signal (X17) | OFF | |
| | Error detection signal (X18) | OFF | |
| | Absolute positioning start complete signal (X21) | OFF | |
| | Synchronization flag (X24) | ON | |
| | Absolute positioning start signal (Y21) | OFF | |
| | Stop signal (Y27) | OFF | |
| | PLC READY signal (Y2D) | ON | |
| Buffer memory | Positioning data | No error | When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value". |

## (3) Device used by the user

| Device | Description |
|---|---|
| X40 | Fixed-feed positioning data write command |
| X41 | Fixed-feed start command |
| D57 | New current value (lower 16 bits) |
| D58 | New current value (upper 16 bits) |
| D60 | Positioning address P1 (lower 16 bits) |
| D61 | Positioning address P1 (upper 16 bits) |
| D62 | Positioning speed V1 (lower 16 bits) |
| D63 | Positioning speed V1 (upper 16 bits) |
| D90 | Current value change request |
| M53 | Fixed-feed positioning data write command pulse |
| M61 | Current value change command |

## (4) Program example




*1 Positioning data can be set through GX Works2 also. (Page 107, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

# 7.3.5 JOG operation program

This program executes JOG operation while a JOG start command is on. Suppose that parameters are already set. (☞Page 115, Section 7.3.1)

## (1) Program detail

- As X42 is turned on, JOG speed is written.

| Item | Setting detail |
|---|---|
| Cd.3 JOG speed | 10000pulse/s |

- As X43 is turned on, the module executes forward JOG operation. As X44 is turned on, the module executes reverse JOG operation.

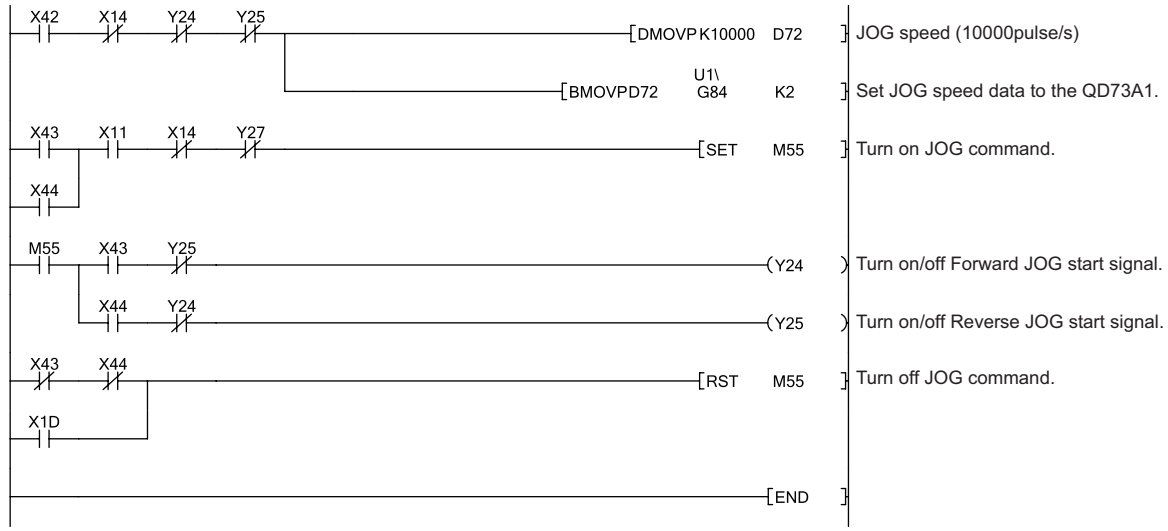
## (2) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | QD73A1 READY signal (X11) | ON | — |
| | BUSY signal (X14) | OFF | |
| | External stop signal (X1D) | OFF | |
| | Synchronization flag (X24) | ON | |
| | Forward JOG start signal (Y24) | OFF | |
| | Reverse JOG start signal (Y25) | OFF | |
| | Stop signal (Y27) | OFF | |
| | PLC READY signal (Y2D) | ON | |
| Buffer memory | Cd.3 JOG speed | No error | When " Cd.3 JOG speed" is set exceeding " Pr.5 Speed limit value", the operation is executed at " Pr.5 Speed limit value". |

## (3) Device used by the user

| Device | Description |
|---|---|
| X42 | JOG speed write command |
| X43 | Forward JOG command |
| X44 | Reverse JOG command |
| D72 | JOG speed (lower 16 bits) |
| D73 | JOG speed (upper 16 bits) |
| M55 | JOG command |

## (4) Program example



# 7.3.6 Control change program

## (1) Current value change program

This program changes the current value to "0".

### (a) Program detail

As X45 is turned on, the current value is changed.

| Item | Setting detail |
|---|---|
| Cd.1 New current value | 0pulse |

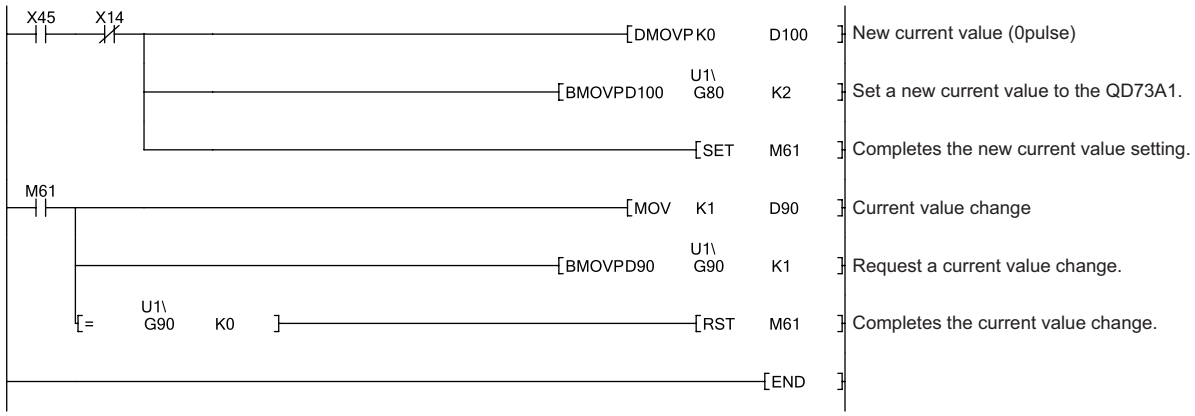
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| I/O signal | WDT error, H/W error signal (X10) | OFF | — |
| | BUSY signal (X14) | OFF | |
| | Error detection signal (X18) | OFF | |
| | Synchronization flag (X24) | ON | |

### (c) Device used by the user

| Device | Description |
|---|---|
| X45 | Current value change command |
| D100 | New current value (lower 16 bits) |
| D101 | New current value (upper 16 bits) |
| D90 | Current value change request |
| M61 | Current value change |

### (d) Program example



## (2) Speed change program

This program changes positioning speed.

### (a) Program detail

As X46 is turned on, positioning speed is changed.

| Item | Setting detail |
|---|---|
| Cd.2 New speed value | 50000pulse/s |

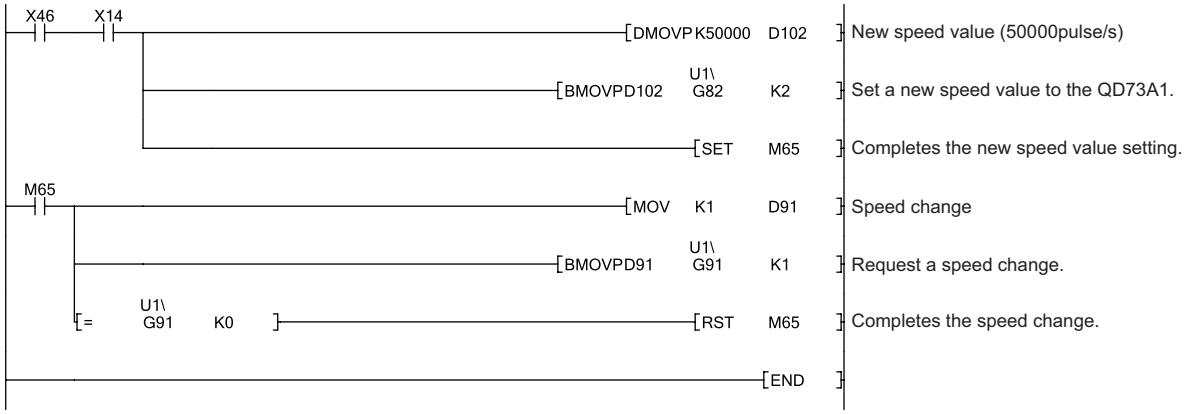
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | WDT error, H/W error signal (X10) | OFF | — |
| | QD73A1 READY signal (X11) | ON | |
| | BUSY signal (X14) | ON | |
| | Excessive error signal (X17) | OFF | |
| | Error detection signal (X18) | OFF | |
| | Synchronization flag (X24) | ON | |
| | Stop signal (Y27) | OFF | |
| | PLC READY signal (Y2D) | ON | |
| Buffer memory | Cd.2 New speed value | No error | When " Cd.2 New speed value" is set exceeding " Pr.5 Speed limit value", the operation is executed at " Pr.5 Speed limit value". |

### (c) Device used by the user

| Device | Description |
|---|---|
| X46 | Speed change command |
| D102 | New speed value (lower 16 bits) |
| D103 | New speed value (upper 16 bits) |
| D91 | Speed change request |
| M65 | Speed change |

### (d) Program example



## (3) Deviation counter clearing program

This program clears the deviation counter to 0.

### (a) Program detail

As X47 is turned on, the deviation counter is cleared to 0.

| Item | Setting detail |
|---|---|
| Cd.4 Deviation counter clear command | 1: Clear the deviation counter |

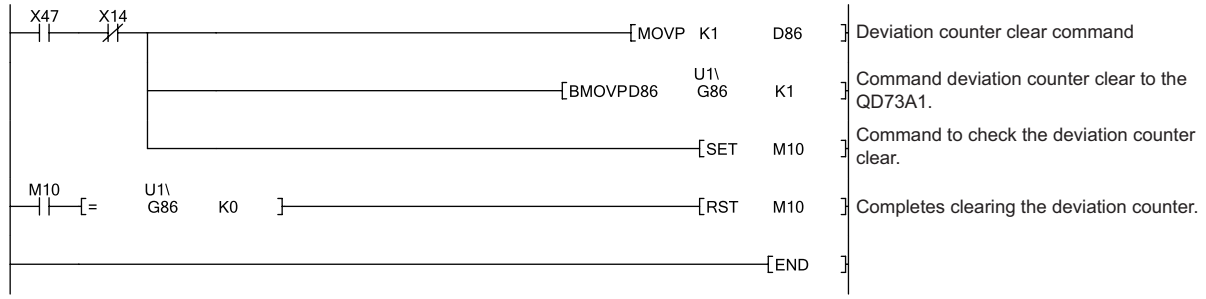
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| I/O signal | WDT error, H/W error signal (X10) | OFF | — |
| | BUSY signal (X14) | OFF | |
| | Error detection signal (X18) | OFF | |
| | Synchronization flag (X24) | ON | |

### (c) Device used by the user

| Device | Description |
|---|---|
| X47 | Deviation counter clear command |
| D86 | Deviation counter clear request |
| M10 | Deviation counter clearing completion check |

### (d) Program example



# 7.3.7 Stop program during positioning

This program stops the positioning in execution.

### (a) Program detail

As X3A is turned on, the module stops the positioning in execution.

### (b) Device used by the user

| Device | Description |
|---|---|
| X3A | Stop command |

### (c) Program example

# 7.4 When Using the Module in a Remote I/O Network

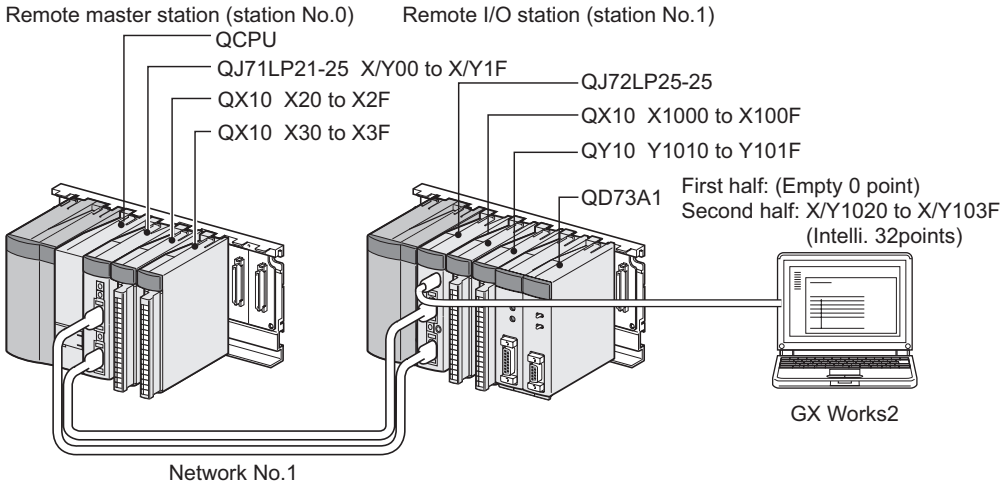
This section introduces program examples of when the QD73A1 is used in a MELSECNET/H remote I/O network.

**Point**

For details on a MELSECNET/H remote I/O network, refer to the following.

Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

## (1) System configuration

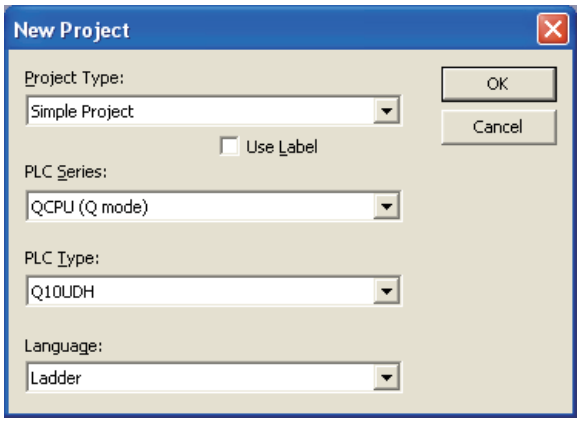


## (2) Setting on the master station

### 1. Create a project on GX Works2.

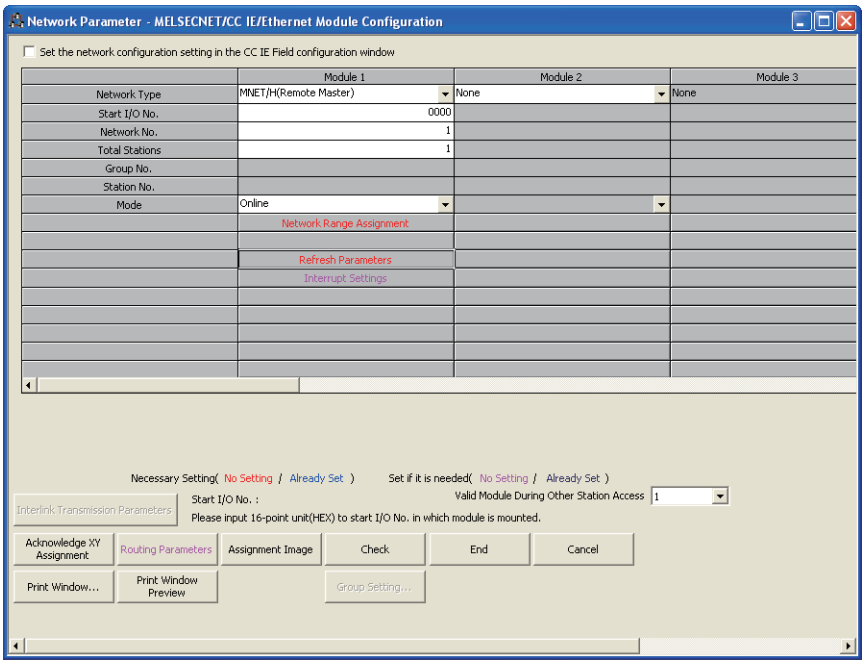
Select "QCPU (Q mode)" for "PLC Series", and select the CPU module used for "PLC Type".

[Project]⇨[New...]




### 2. Display the network parameter setting window, and configure the setting as follows.

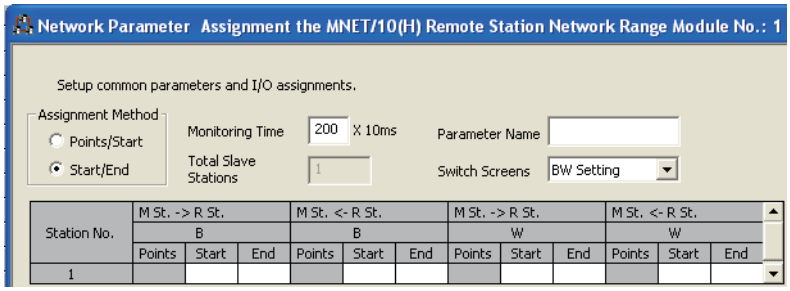
Project window⇨[Parameter]⇨[Network Parameter]
⇨[Ethernet/CC IE/MELSECNET]



**3.** **Display the network range assignment setting window, and configure the setting as follows.**

Project window➪[Parameter]➪[Network Parameter]

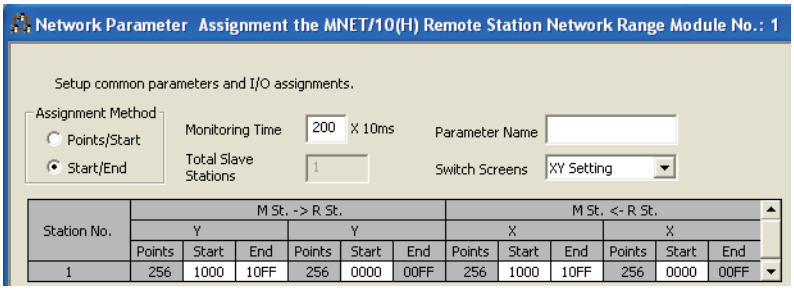
➪[Ethernet/CC IE/MELSECNET]➪ Network Range Assignment button




Project window➪[Parameter]➪[Network Parameter]

➪[Ethernet/CC IE/MELSECNET]➪ Network Range Assignment button➪"Switch Screens"

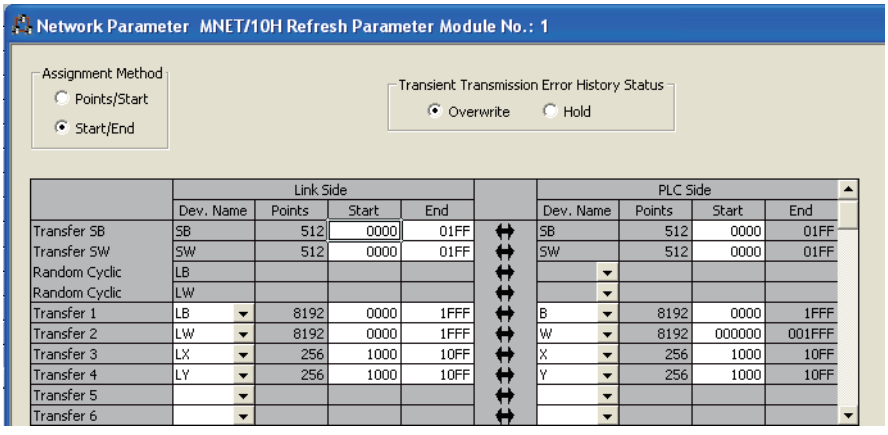
➪"XY Setting"




**4.** **Display the refresh parameter setting window, and configure the setting as follows.**

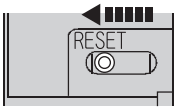
Project window➪[Parameter]➪[Network Parameter]

➪[Ethernet/CC IE/MELSECNET]➪ Refresh Parameters button




**5.** **Write the set parameters to the CPU module on the master station. Then reset the CPU module or turn off and on the power supply of the programmable controller.**

[Online]➪[Write to PLC...]



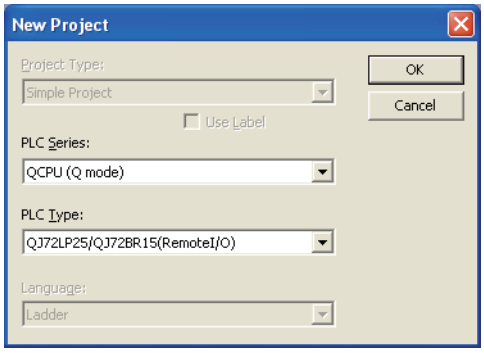

or Power off → on

## (3) Setting on the remote I/O station

**1. Create a project on GX Works2.**

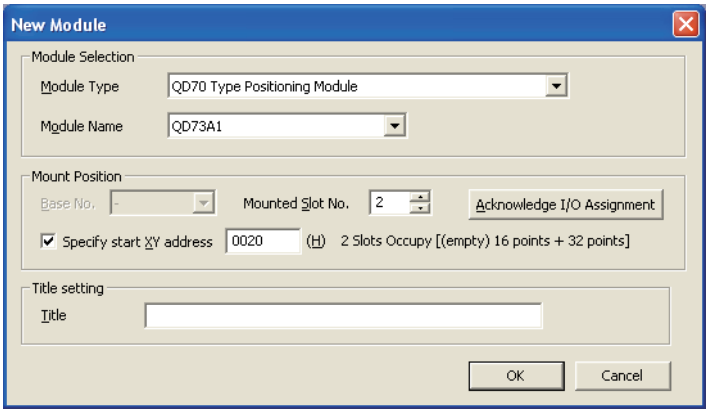
Select "QCPU (Q mode)" for "PLC Series", and select "QJ72LP25/QJ72BR15(RemoteI/O)" for "PLC Type".

[Project]⇨[New...]



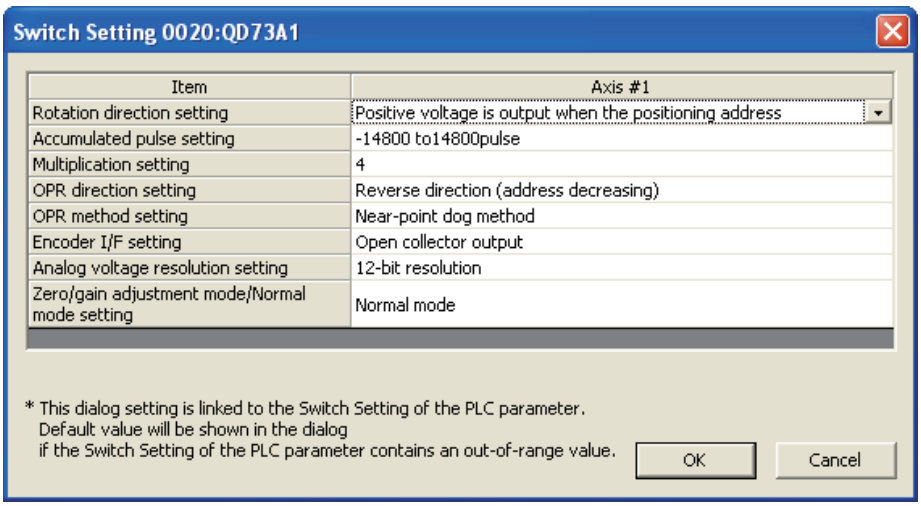

**2. Add the QD73A1 to the project on GX Works2.**

Project window⇨[Intelligent Function Module]⇨Right-click⇨[New Module...]



**3. Display the QD73A1's switch setting window, and configure the setting as follows.**

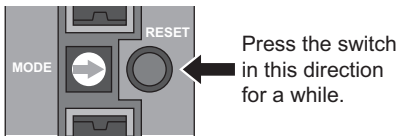
Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]




| Item | Setting value |
|---|---|
| Rotation direction setting | Set this item according to the system to be used. |
| Accumulated pulse setting | Set this item according to the system to be used. |
| Multiplication setting | Set this item according to the system to be used. |
| OPR direction setting | Set this item according to the system to be used. |
| OPR method setting | Set the near-point dog method or the count method. |
| Encoder I/F setting | Set this item according to the system to be used. |
| Analog voltage resolution setting | Set this item according to the system to be used. |
| Zero/gain adjustment mode/Normal mode setting | Set "Normal mode". |

**4. Write the set parameters to the remote I/O module, then reset the remote I/O module.**

[Online]⇨[Write to PLC...]



## (4) I/O signals of the QD73A1

The following is the I/O signal assignment viewed from the master station side.

### (a) Input signal list

| Input signal (CPU module ← QD73A1) | | Input signal (CPU module ← QD73A1) | |
|---|---|---|---|
| **Device No.** | **Signal name** | **Device No.** | **Signal name** |
| X1020 | WDT error, H/W error signal | X1030 | OPR start complete signal |
| X1021 | QD73A1 READY signal | X1031 | Absolute positioning start complete signal |
| X1022 | OPR request signal | X1032 | Forward start complete signal |
| X1023 | OPR complete signal | X1033 | Reverse start complete signal |
| X1024 | BUSY signal | X1034 | Synchronization flag |
| X1025 | Positioning complete signal | X1035 | Use prohibited |
| X1026 | In-position signal | X1036 | |
| X1027 | Excessive error signal | X1037 | |
| X1028 | Error detection signal | X1038 | |
| X1029 | Overflow signal | X1039 | |
| X102A | Underflow signal | X103A | Zero/gain adjustment data writing complete flag |
| X102B | Servo READY signal | X103B | Zero/gain adjustment change complete flag |
| X102C | Near-point dog signal | X103C | Set value change complete flag |
| X102D | External stop signal | X103D | Operating status of the speed-position control switch mode |
| X102E | Upper limit signal | X103E | Use prohibited |
| X102F | Lower limit signal | X103F | |

### (5) Output signal list

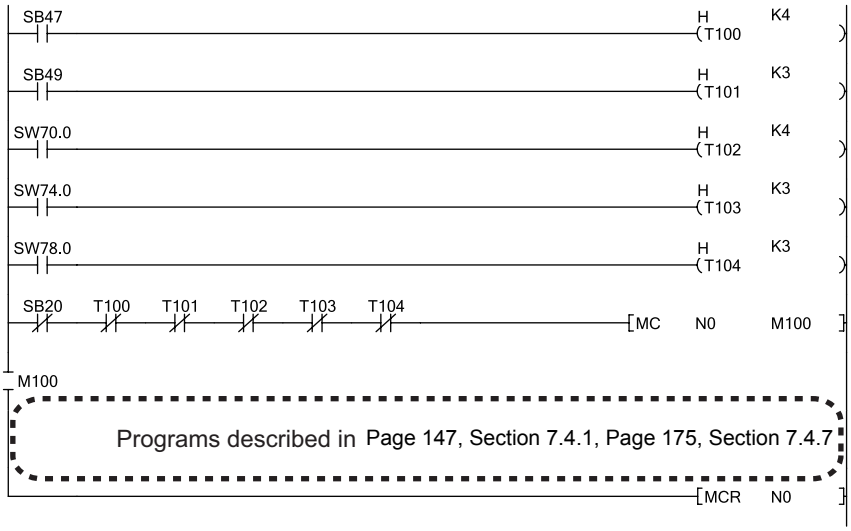
| Output signal (CPU module → QD73A1) | | Output signal (CPU module → QD73A1) | |
|---|---|---|---|
| **Device No.** | **Signal name** | **Device No.** | **Signal name** |
| Y1020 | Use prohibited | Y1030 | OPR start signal |
| Y1021 | | Y1031 | Absolute positioning start signal |
| Y1022 | | Y1032 | Forward start signal |
| Y1023 | | Y1033 | Reverse start signal |
| Y1024 | | Y1034 | Forward JOG start signal |
| Y1025 | | Y1035 | Reverse JOG start signal |
| Y1026 | | Y1036 | Speed-position mode restart signal |
| Y1027 | | Y1037 | Stop signal |
| Y1028 | | Y1038 | Error reset signal |
| Y1029 | | Y1039 | Overflow reset signal |
| Y102A | Zero/gain adjustment data writing request signal | Y103A | Underflow reset signal |
| Y102B | Zero/gain adjustment change request signal | Y103B | Use prohibited |
| Y102C | Set value change request signal | Y103C | Speed-position switching enable signal |
| Y102D | Use prohibited | Y103D | PLC READY signal |
| Y102E | | Y103E | Use prohibited |
| Y102F | | Y103F | |

**Point**

If a "Use prohibited" area is turned on/off through a sequence program, the QD73A1's function cannot be guaranteed.

## (6) Interlock program of MELSECNET/H remote I/O network

For programs introduced in Page 147, Section 7.4.1 to Page 175, Section 7.4.7, make interlocks using data link status of the own station and the other station as shown below.




## (7) Program example

Refer to the following.

| Program example | Reference |
|---|---|
| Parameter setting program | Page 147, Section 7.4.1 |
| Near-point dog method OPR program | Page 149, Section 7.4.2 (1) |
| Count method OPR program | Page 152, Section 7.4.2 (2) |
| Positioning control program | Page 155, Section 7.4.3 (1) |
| Two-phase trapezoidal positioning control program | Page 157, Section 7.4.3 (2) |
| Speed-position control switch mode program | Page 159, Section 7.4.3 (3) |
| Speed control operation program | Page 162, Section 7.4.3 (4) |
| Fixed-feed operation program | Page 165, Section 7.4.4 |
| JOG operation program | Page 168, Section 7.4.5 |
| Current value change program | Page 170, Section 7.4.6 (1) |
| Speed change program | Page 172, Section 7.4.6 (2) |
| Deviation counter clearing program | Page 174, Section 7.4.6 (3) |
| Stop program during positioning | Page 175, Section 7.4.7 |

# 7.4.1 Parameter setting program

This program sets fixed parameters and variable parameters.

**Point**

Parameters described in this section can be set through GX Works2 also. (Page 106, Section 6.3)
The sequence program in this section is unnecessary when the parameters were set through GX Works2.

## (1) Program detail

- As X20 is turned on, the following fixed parameters are set.

| Item | Setting detail |
|---|---|
| Pr.1 Stroke limit upper limit | 20000000pulse |
| Pr.2 Stroke limit lower limit | 0pulse |
| Pr.3 Numerator of command pulse multiplication for electronic gear | 1 |
| Pr.4 Denominator of command pulse multiplication for electronic gear | 1 |

- As X21 is turned on, the following variable parameters are set.

| Item | Setting detail |
|---|---|
| Pr.5 Speed limit value | 30000pulse |
| Pr.6 Acceleration time | 400ms |
| Pr.7 Deceleration time | 250ms |
| Pr.8 In-position range | 10pulse |
| Pr.9 Positioning mode | 0: Position control mode |

## (2) Execution condition

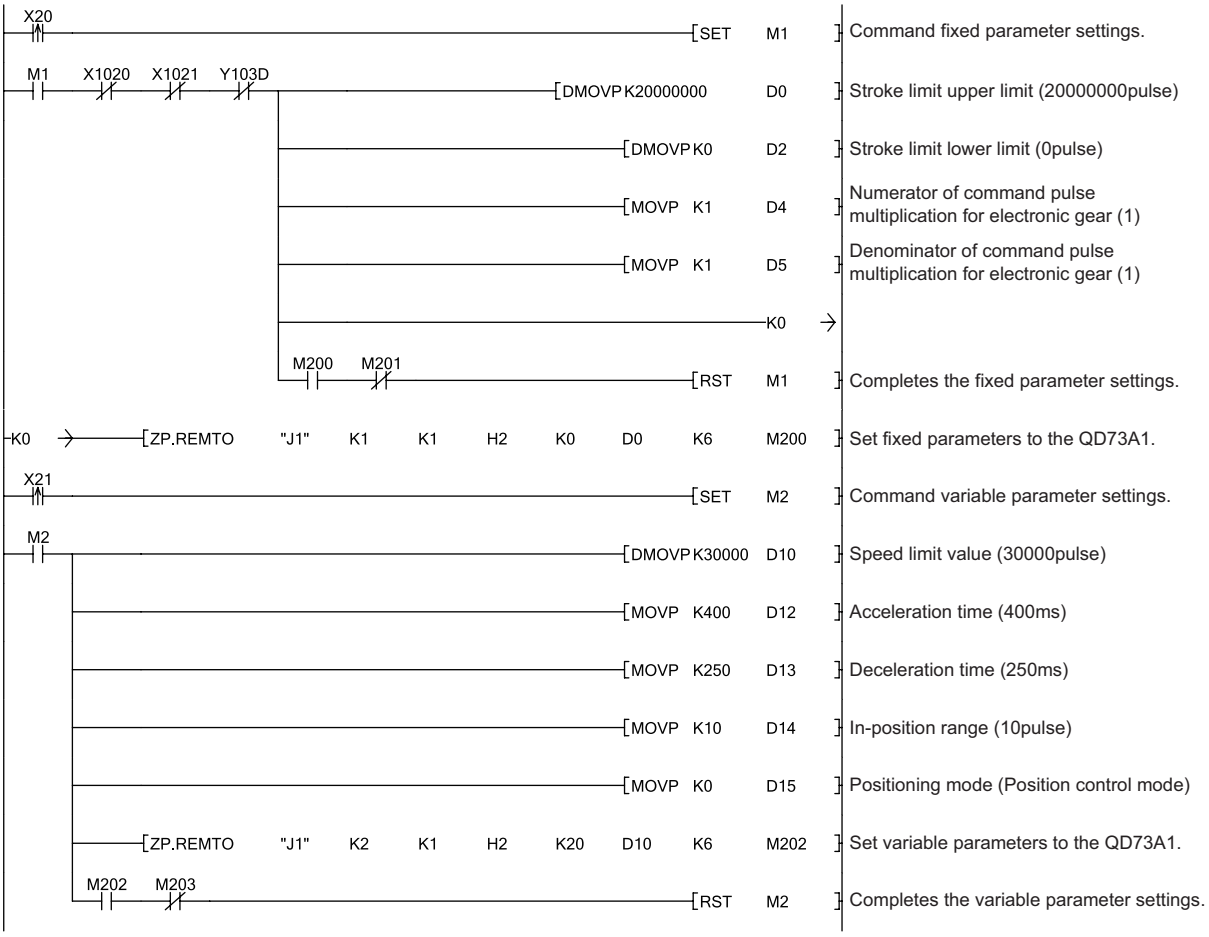
| Check item | | Condition |
|---|---|---|
| I/O signal | WDT error, H/W error signal (X1020) | OFF |
| | QD73A1 READY signal (X1021) | OFF |
| | PLC READY signal (Y103D) | OFF |

## (3) Device used by the user

| Device | Description |
|---|---|
| X20 | Fixed parameter setting command |
| X21 | Variable parameter setting command |
| D0 | Stroke limit upper limit (lower 16 bits) |
| D1 | Stroke limit upper limit (upper 16 bits) |
| D2 | Stroke limit lower limit (lower 16 bits) |
| D3 | Stroke limit lower limit (upper 16 bits) |
| D4 | Numerator of command pulse multiplication for electronic gear |
| D5 | Denominator of command pulse multiplication for electronic gear |
| D10 | Speed limit value (lower 16 bits) |

| Device | Description |
|---|---|
| D11 | Speed limit value (upper 16 bits) |
| D12 | Acceleration time |
| D13 | Deceleration time |
| D14 | In-position range |
| D15 | Positioning mode |
| M1 | Fixed parameter setting memory |
| M2 | Variable parameter setting memory |
| M200 | Z(P).REMTO instruction completion |
| M201 | Z(P).REMTO instruction failure |
| M202 | Z(P).REMTO instruction completion |
| M203 | Z(P).REMTO instruction failure |

## (4) Program example



# 7.4.2 OPR program

Programs in this section execute OPR in the near-point dog method or the count method.

## (1) Near-point dog method OPR program

This program executes OPR in the near-point dog method. Suppose that fixed parameters and variable parameters are already set. (☞Page 147, Section 7.4.1)

### (a) Program detail

- As X22 is turned on, the following OPR parameters are written and PLC READY signal (Y103D) turns on.

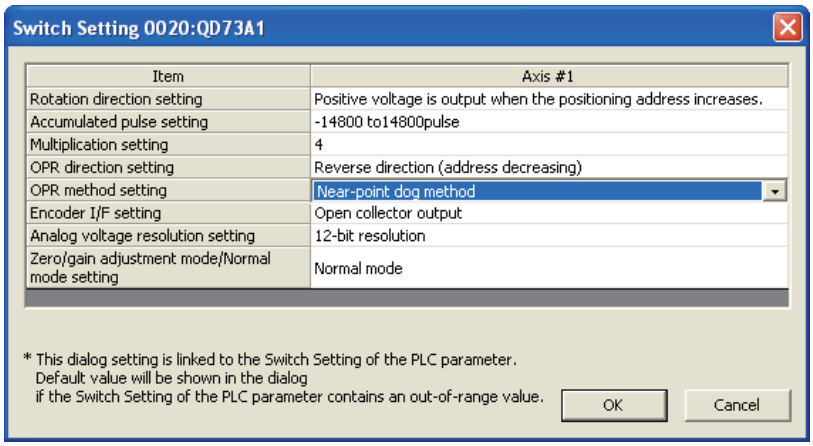
| Item | Setting detail |
|---|---|
| Pr.10 OP address | 100pulse |
| Pr.11 OPR speed | 5000pulse/s |
| Pr.12 Creep speed | 500pulse/s |

- As X23 is turned on after PLC READY signal (Y103D) turned on, the module executes OPR.

### (b) Switch setting

Before executing the program, set "Near-point dog method" to "OPR method setting".

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]



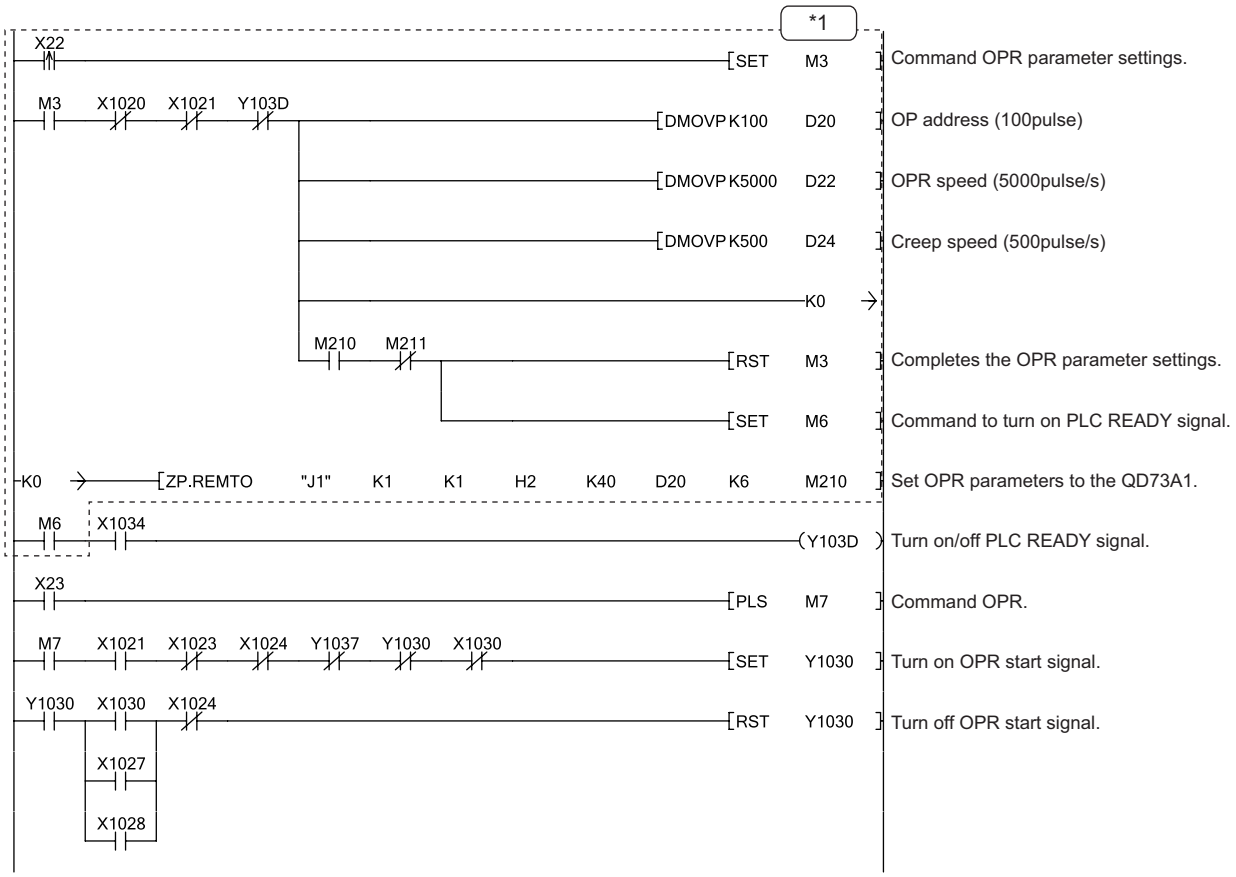
### (c) Execution condition

| Check item | | Condition |
|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON |
| | Stop signal (STOP) | OFF |
| | Upper limit signal (FLS) | ON |
| | Lower limit signal (RLS) | ON |
| | Near-point dog signal (DOG) | OFF |
| I/O signal | WDT error, H/W error signal (X1020) | OFF |
| | QD73A1 READY signal (X1021) | OFF |
| | OPR complete signal (X1023) | OFF |
| | BUSY signal (X1024) | OFF |
| | Excessive error signal (X1027) | OFF |
| | Error detection signal (X1028) | OFF |
| | OPR start complete signal (X1030) | OFF |
| | Synchronization flag (X1034) | ON |
| | OPR start signal (Y1030) | OFF |
| | Stop signal (Y1037) | OFF |
| | PLC READY signal (Y103D) | OFF |
| Buffer memory | OPR parameters | No error |

### (d) Device used by the user

| Device | Description |
|---|---|
| X22 | OPR parameter setting command |
| X23 | OPR command |
| D20 | OP address (lower 16 bits) |
| D21 | OP address (upper 16 bits) |
| D22 | OPR speed (lower 16 bits) |
| D23 | OPR speed (upper 16 bits) |
| D24 | Creep speed (lower 16 bits) |
| D25 | Creep speed (upper 16 bits) |
| M3 | OPR parameter writing |
| M6 | OPR parameter setting memory |
| M7 | OPR command pulse |
| M210 | Z(P).REMTO instruction completion |
| M211 | Z(P).REMTO instruction failure |

### (e) Program example




*1 OPR parameters can be set through GX Works2 also. (☞ Page 106, Section 6.3)
The sequence program that sets OPR parameters is unnecessary when the parameters were set through GX Works2.

## (2) Count method OPR program

This program executes OPR in the count method. Suppose that fixed parameters and variable parameters are already set. (Page 147, Section 7.4.1)

### (a) Program detail

- As X22 is turned on, the following OPR parameters are written and PLC READY signal (Y103D) turns on.

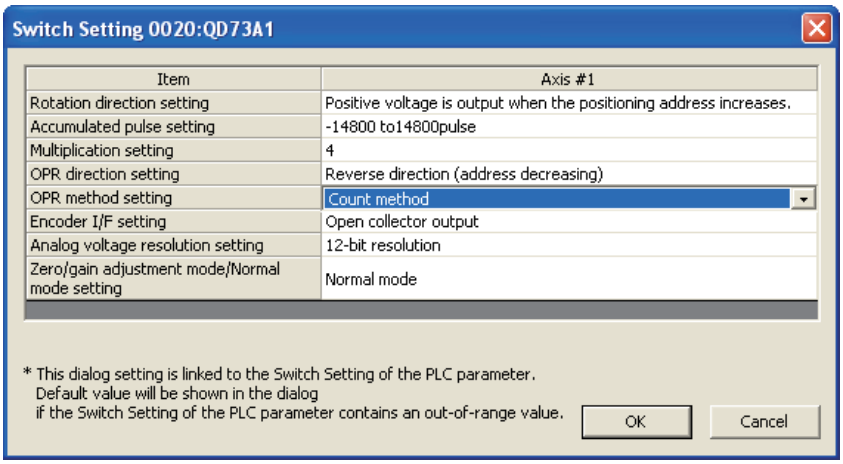
| Item | Setting detail |
|---|---|
| Pr.10 OP address | 100pulse |
| Pr.11 OPR speed | 5000pulse/s |
| Pr.12 Creep speed | 500pulse/s |
| Pr.13 Setting for the movement amount after near-point dog ON | 2000pulse |

- As X24 is turned on after PLC READY signal (Y103D) turned on, the module executes OPR.

### (b) Switch setting

Before executing the program, set "Count method" to "OPR method setting".

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]



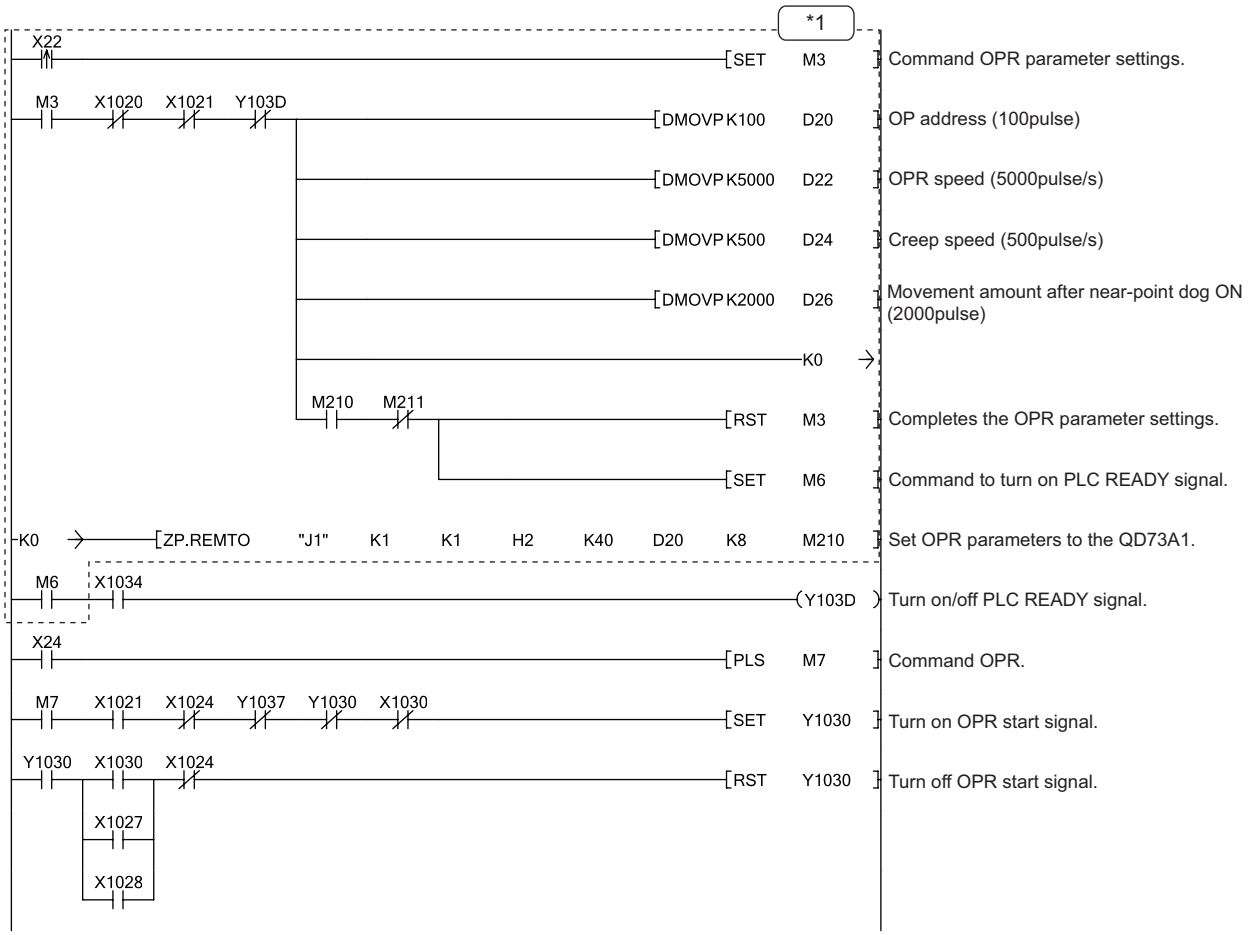
### (c) Execution condition

| Check item | | Condition |
|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON |
| | Stop signal (STOP) | OFF |
| | Upper limit signal (FLS) | ON |
| | Lower limit signal (RLS) | ON |
| I/O signal | WDT error, H/W error signal (X1020) | OFF |
| | QD73A1 READY signal (X1021) | OFF |
| | BUSY signal (X1024) | OFF |
| | Excessive error signal (X1027) | OFF |
| | Error detection signal (X1028) | OFF |
| | OPR start complete signal (X1030) | OFF |
| | Synchronization flag (X1034) | ON |
| | OPR start signal (Y1030) | OFF |
| | Stop signal (Y1037) | OFF |
| | PLC READY signal (Y103D) | OFF |
| Buffer memory | OPR parameters | No error |

### (d) Device used by the user

| Device | Description |
|---|---|
| X22 | OPR parameter setting command |
| X24 | OPR command |
| D20 | OP address (lower 16 bits) |
| D21 | OP address (upper 16 bits) |
| D22 | OPR speed (lower 16 bits) |
| D23 | OPR speed (upper 16 bits) |
| D24 | Creep speed (lower 16 bits) |
| D25 | Creep speed (upper 16 bits) |
| D26 | Movement amount after near-point dog ON (lower 16 bits) |
| D27 | Movement amount after near-point dog ON (upper 16 bits) |
| M3 | OPR parameter writing |
| M6 | OPR parameter setting memory |
| M7 | OPR command pulse |
| M210 | Z(P).REMTO instruction completion |
| M211 | Z(P).REMTO instruction failure |

### (e) Program example




*1 OPR parameters can be set through GX Works2 also. (☞ Page 106, Section 6.3)
The sequence program that sets OPR parameters is unnecessary when the parameters were set through GX Works2.

# 7.4.3 Major positioning control program

Programs in this section execute major positioning control.

## (1) Positioning control program

This program executes positioning control in the absolute system. Suppose that the parameter setting and OPR were completed. (☞Page 147, Section 7.4.1, Page 149, Section 7.4.2)

### (a) Program detail

- As X25 is turned on, the following positioning data are written.

| Item | Setting detail |
|---|---|
| Da.1 Positioning pattern | 0: Positioning control |
| Da.2 Positioning address P1 | 100000pulse |
| Da.3 Positioning speed V1 | 10000pulse/s |

- As X26 is turned on, the module executes positioning control in the absolute system.

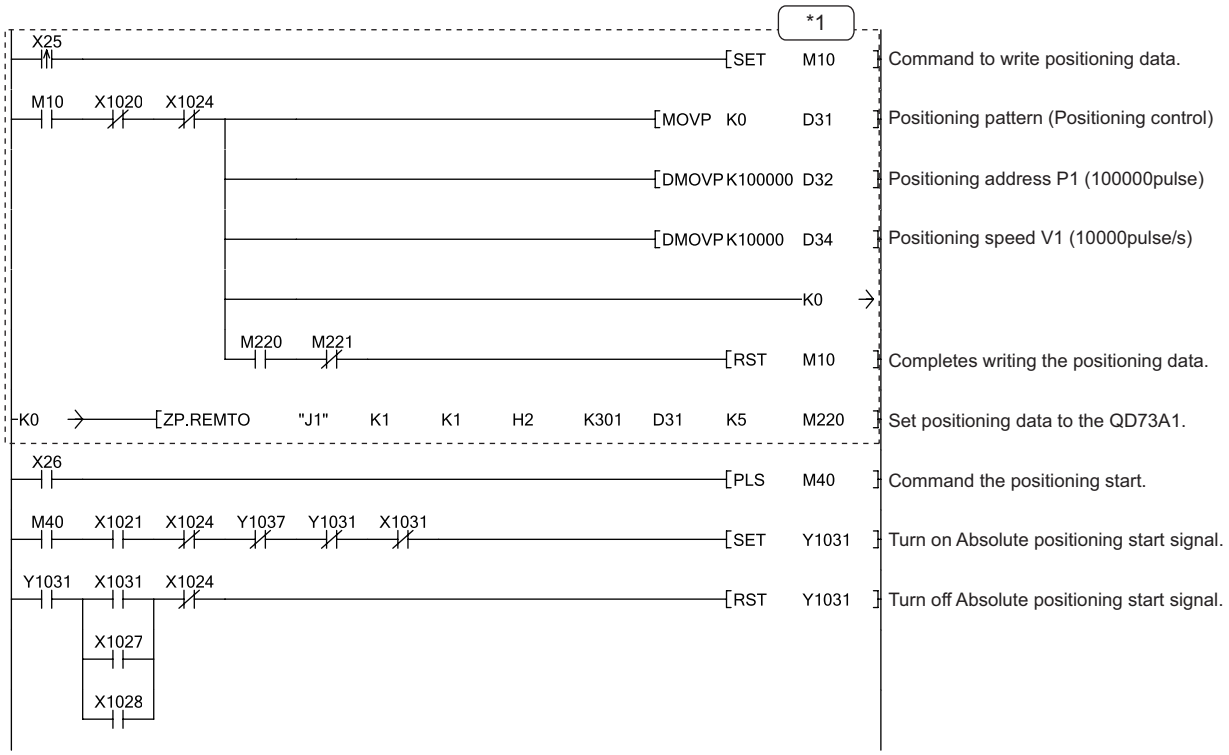
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | WDT error, H/W error signal (X1020) | OFF | — |
| | QD73A1 READY signal (X1021) | ON | |
| | BUSY signal (X1024) | OFF | |
| | Excessive error signal (X1027) | OFF | |
| | Error detection signal (X1028) | OFF | |
| | Absolute positioning start complete signal (X1031) | OFF | |
| | Synchronization flag (X1034) | ON | |
| | Absolute positioning start signal (Y1031) | OFF | |
| | Stop signal (Y1037) | OFF | |
| | PLC READY signal (Y103D) | ON | |
| Buffer memory | Positioning data | No error | When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value". |

### (c) Device used by the user

| Device | Description |
|---|---|
| X25 | Positioning data write command |
| X26 | Positioning start command |
| D31 | Positioning pattern |
| D32 | Positioning address P1 (lower 16 bits) |
| D33 | Positioning address P1 (upper 16 bits) |
| D34 | Positioning speed V1 (lower 16 bits) |
| D35 | Positioning speed V1 (upper 16 bits) |
| M10 | Positioning data writing |
| M40 | Positioning start command pulse |
| M220 | Z(P).REMTO instruction completion |
| M221 | Z(P).REMTO instruction failure |

### (d) Program example




*1 Positioning data can be set through GX Works2 also. (☞ Page 107, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

## (2) Two-phase trapezoidal positioning control program

This program executes two-phase trapezoidal positioning control in the absolute system. Suppose that the parameter setting and OPR were completed. (☞Page 147, Section 7.4.1, Page 149, Section 7.4.2)

### (a) Program detail

- As X27 is turned on, the following positioning data are written.

| Item | Setting detail |
|---|---|
| Da.1 Positioning pattern | 1: Two-phase trapezoidal positioning control |
| Da.2 Positioning address P1 | 100000pulse |
| Da.3 Positioning speed V1 | 10000pulse/s |
| Da.4 Positioning address P2 | 150000pulse |
| Da.5 Positioning speed V2 | 12000pulse/s |

- As X28 is turned on, the module executes two-phase trapezoidal positioning control in the absolute system.

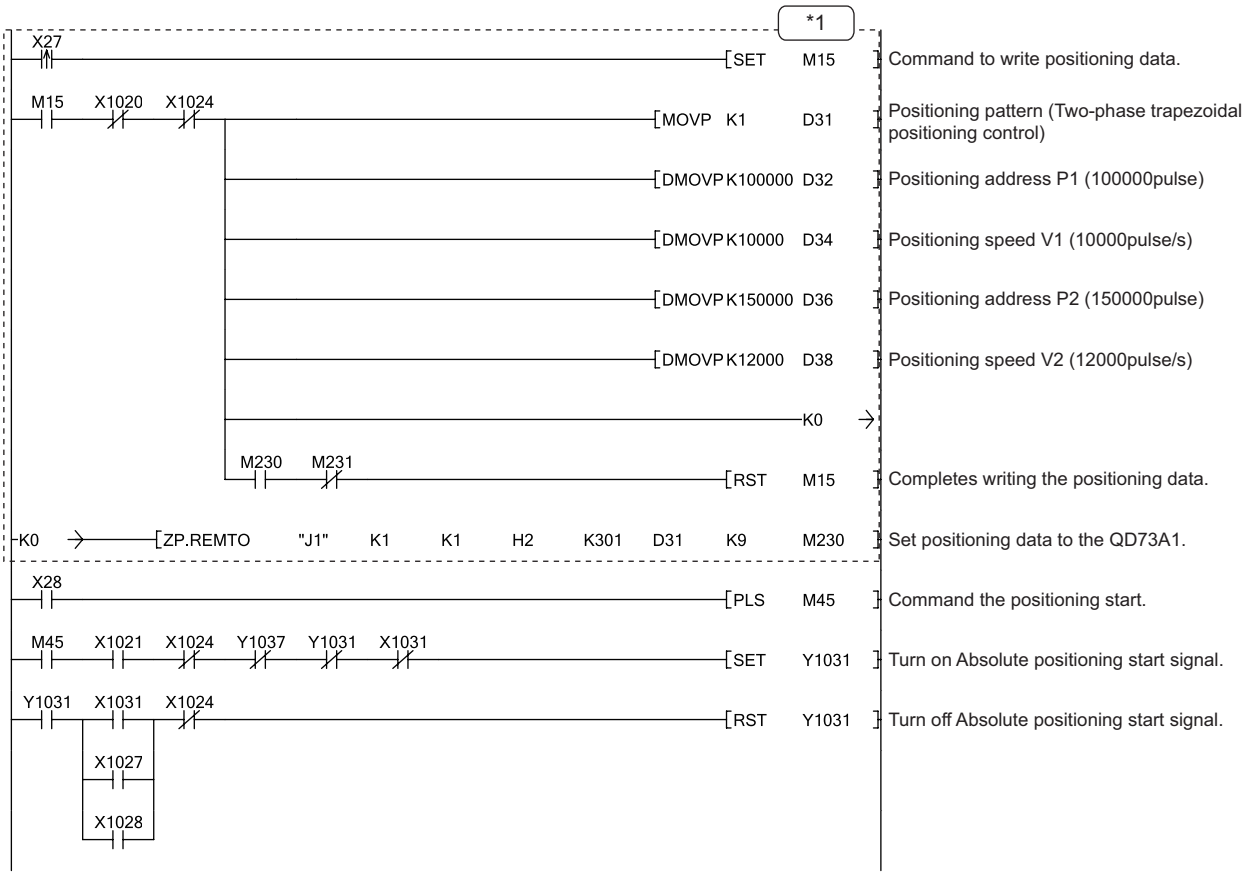
### (b) Execution condition

The execution condition is the same as that of positioning control program. (☞Page 155, Section 7.4.3 (1) (b))

### (c) Device used by the user

| Device | Description |
|---|---|
| X27 | Positioning data write command |
| X28 | Two-phase trapezoidal positioning control start command |
| D31 | Positioning pattern |
| D32 | Positioning address P1 (lower 16 bits) |
| D33 | Positioning address P1 (upper 16 bits) |
| D34 | Positioning speed V1 (lower 16 bits) |
| D35 | Positioning speed V1 (upper 16 bits) |
| D36 | Positioning address P2 (lower 16 bits) |
| D37 | Positioning address P2 (upper 16 bits) |
| D38 | Positioning speed V2 (lower 16 bits) |
| D39 | Positioning speed V2 (upper 16 bits) |
| M15 | Positioning data writing |
| M45 | Two-phase trapezoidal positioning control start command pulse |
| M230 | Z(P).REMTO instruction completion |
| M231 | Z(P).REMTO instruction failure |

### (d) Program example




*1 Positioning data can be set through GX Works2 also. (☞ Page 107, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

## (3) Speed-position control switch mode program

This program switches the positioning mode to the "speed-position control switch mode". Suppose that the parameter setting and OPR were completed. (☞Page 147, Section 7.4.1, Page 149, Section 7.4.2)

### (a) Program detail

- As X29 is turned on, the positioning mode is set to "speed-position control switch mode".
- As X2A is turned on, the following positioning data are written.

| Item | Setting detail |
|---|---|
| Da.2 Positioning address P1 | 5000pulse |
| Da.3 Positioning speed V1 | 1000pulse/s |

- As X2B is turned on, the module starts speed control. The module switches the operation to position control following an external control switch command.
- As X2D is turned on, the module restarts operation in case that the operation was stopped following a stop signal input.

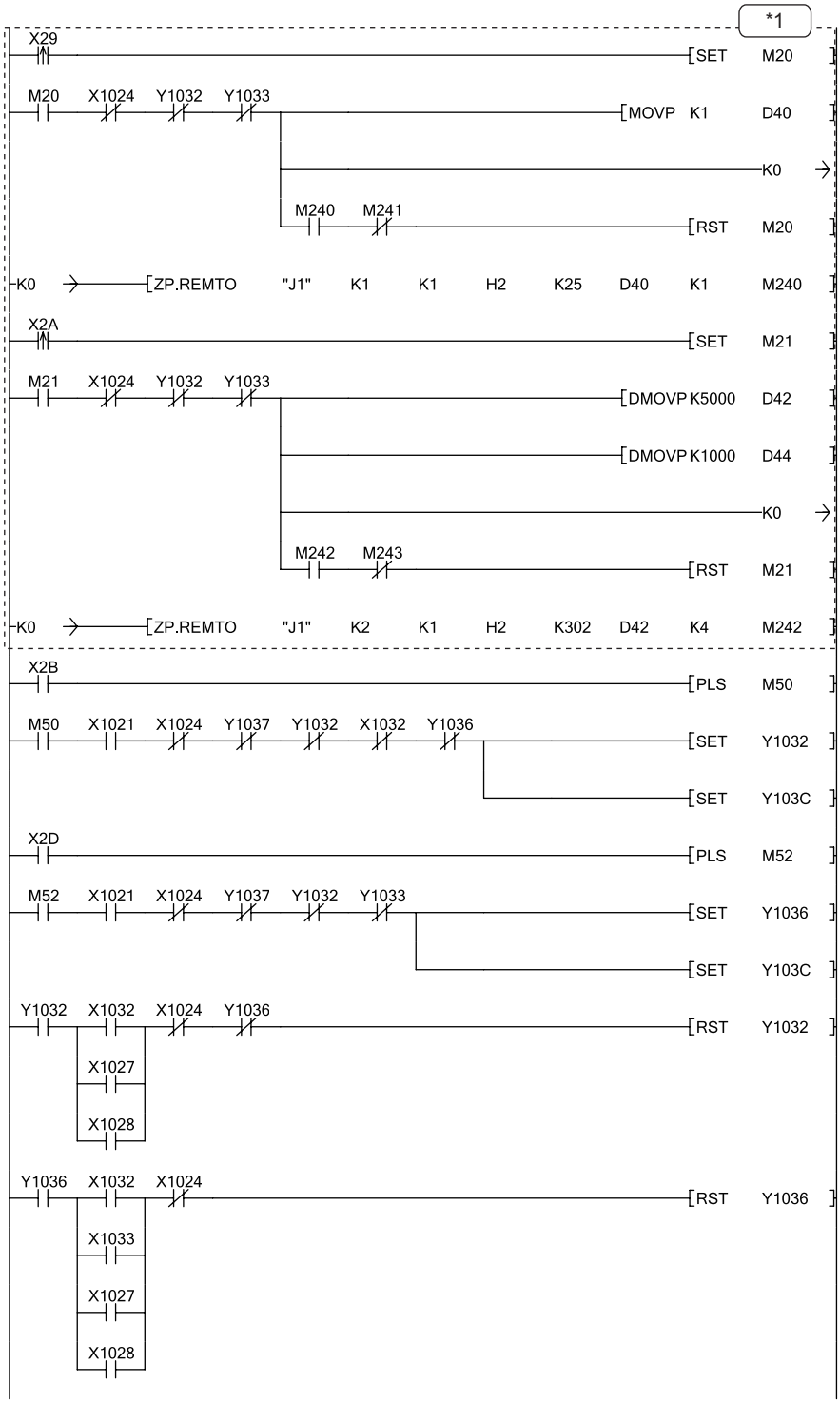
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | QD73A1 READY signal (X1021) | ON | — |
| | BUSY signal (X1024) | OFF | |
| | Excessive error signal (X1027) | OFF | |
| | Error detection signal (X1028) | OFF | |
| | Forward start complete signal (X1032) | OFF | |
| | Synchronization flag (X1034) | ON | |
| | Forward start signal (Y1032) | OFF | |
| | Reverse start signal (Y1033) | OFF | |
| | Speed-position mode restart signal (Y1036) | OFF | |
| | Stop signal (Y1037) | OFF | |
| | Speed-position switching enable signal (Y103C) | OFF | |
| | PLC READY signal (Y103D) | ON | |
| Buffer memory | Positioning data | No error | When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value". |

### (c) Device used by the user

| Device | Description |
|---|---|
| X29 | Variable parameter change command |
| X2A | Positioning data write command |
| X2B | Speed-position control positioning start command |
| X2D | Speed-position control positioning restart command |
| D40 | Positioning mode |
| D42 | Positioning address P1 (lower 16 bits) |
| D43 | Positioning address P1 (upper 16 bits) |
| D44 | Positioning speed V1 (lower 16 bits) |
| D45 | Positioning speed V1 (upper 16 bits) |
| M20 | Variable parameter change |
| M21 | Positioning data writing |
| M50 | Speed-position control positioning start command pulse |
| M52 | Speed-position control positioning restart command pulse |
| M240 | Z(P).REMTO instruction completion |
| M241 | Z(P).REMTO instruction failure |
| M242 | Z(P).REMTO instruction completion |
| M243 | Z(P).REMTO instruction failure |

### (d) Program example




*1 Variable parameters and positioning data can be set through GX Works2 also. (☞ Page 106, Section 6.3, Page 107, Section 6.4)
The sequence program that sets variable parameters and positioning data is unnecessary when the data were set through GX Works2.

## (4) Speed control operation program

This program executes speed control using the speed control function of the speed-position control switch mode. Suppose that parameters are already set. (☞Page 147, Section 7.4.1)

### (a) Program detail

- As X2E is turned on, the positioning mode is set to "speed-position control switch mode".
- As X2F is turned on, the following positioning data is written.

| Item | Setting detail |
|---|---|
| Da.3 Positioning speed V1 | 1000pulse/s |

- As X30 is turned on, the module starts speed control of forward run. As X31 is turned on, the module starts speed control of reverse run.

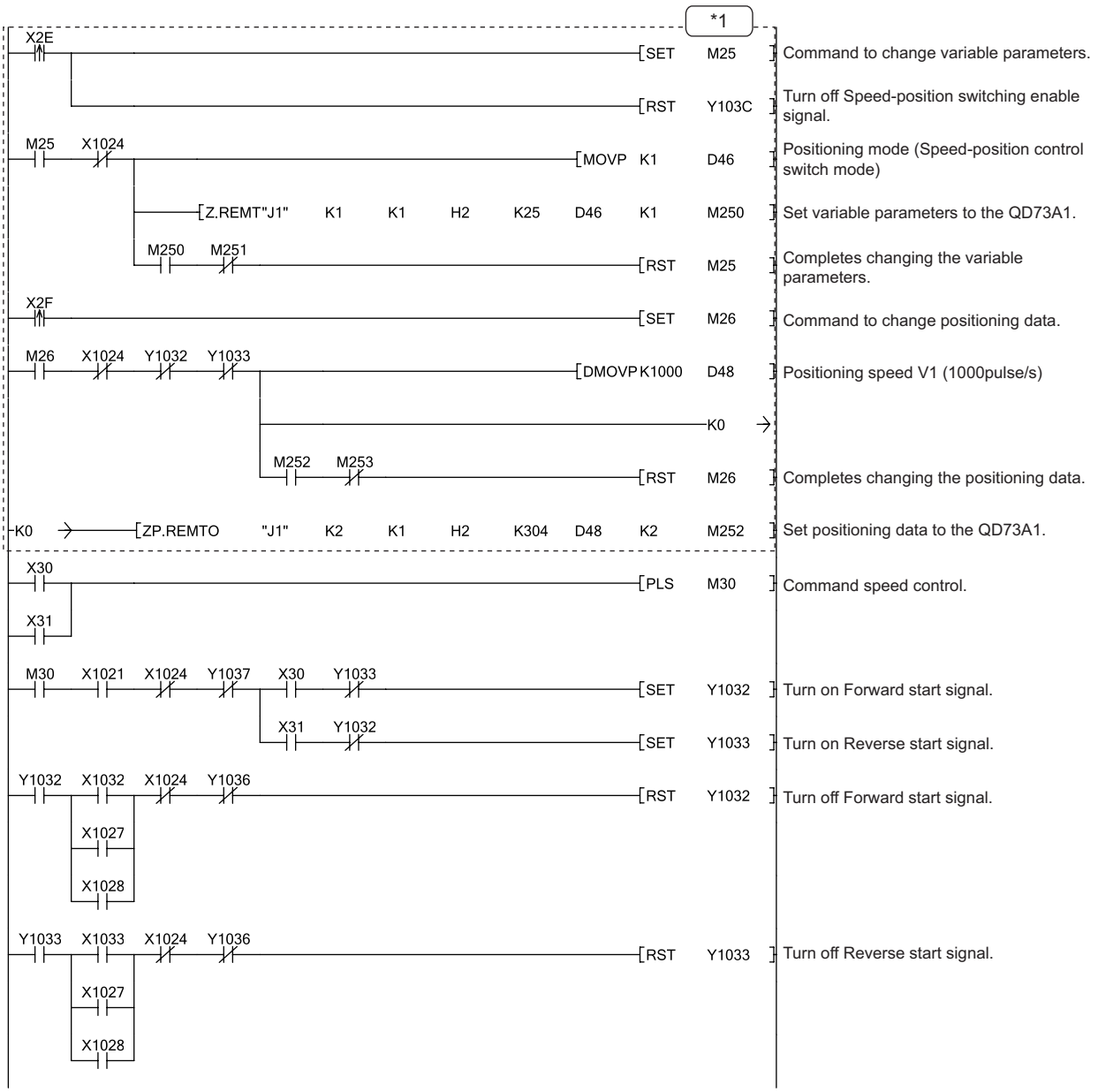
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | QD73A1 READY signal (X1021) | ON | — |
| | BUSY signal (X1024) | OFF | |
| | Excessive error signal (X1027) | OFF | |
| | Error detection signal (X1028) | OFF | |
| | Forward start complete signal (X1032) | OFF | |
| | Reverse start complete signal (X1033) | OFF | |
| | Synchronization flag (X1034) | ON | |
| | Forward start signal (Y1032) | OFF | |
| | Reverse start signal (Y1033) | OFF | |
| | Speed-position mode restart signal (Y1036) | OFF | |
| | Stop signal (Y1037) | OFF | |
| | Speed-position switching enable signal (Y103C) | OFF | |
| | PLC READY signal (Y103D) | ON | |
| Buffer memory | Positioning data | No error | When the positioning speed is set exceeding "Pr.5 Speed limit value", the positioning is executed at "Pr.5 Speed limit value". |

### (c) Device used by the user

| Device | Description |
|---|---|
| X2E | Variable parameter change command |
| X2F | Positioning data write command |
| X30 | Forward run command |
| X31 | Reverse run command |
| D46 | Positioning mode |
| D48 | Positioning speed V1 (lower 16 bits) |
| D49 | Positioning speed V1 (upper 16 bits) |
| M25 | Variable parameter change |
| M26 | Positioning data writing |
| M30 | Speed control command pulse |
| M250 | Z(P).REMTO instruction completion |
| M251 | Z(P).REMTO instruction failure |
| M252 | Z(P).REMTO instruction completion |
| M253 | Z(P).REMTO instruction failure |

### (d) Program example




*1 Variable parameters and positioning data can be set through GX Works2 also. (☞ Page 106, Section 6.3, Page 107, Section 6.4)
The sequence program that sets variable parameters and positioning data is unnecessary when the data were set through GX Works2.

# 7.4.4 Fixed-feed operation program

This program executes positioning in the address increasing direction according to the specified movement amount and speed. Execute fixed-feed operation by turning on Fixed-feed start command repeatedly. Use the current value change function and positioning start in the absolute system. Suppose that parameter setting and OPR were completed. (☞ Page 147, Section 7.4.1, Page 149, Section 7.4.2)

## (1) Program detail

- As X32 is turned on, the following positioning data are written.

| Item | Setting detail |
|---|---|
| Da.2 Positioning address P1 | 20000pulse |
| Da.3 Positioning speed V1 | 1000pulse/s |

- As X33 is turned on, the module starts fixed-feed operation.

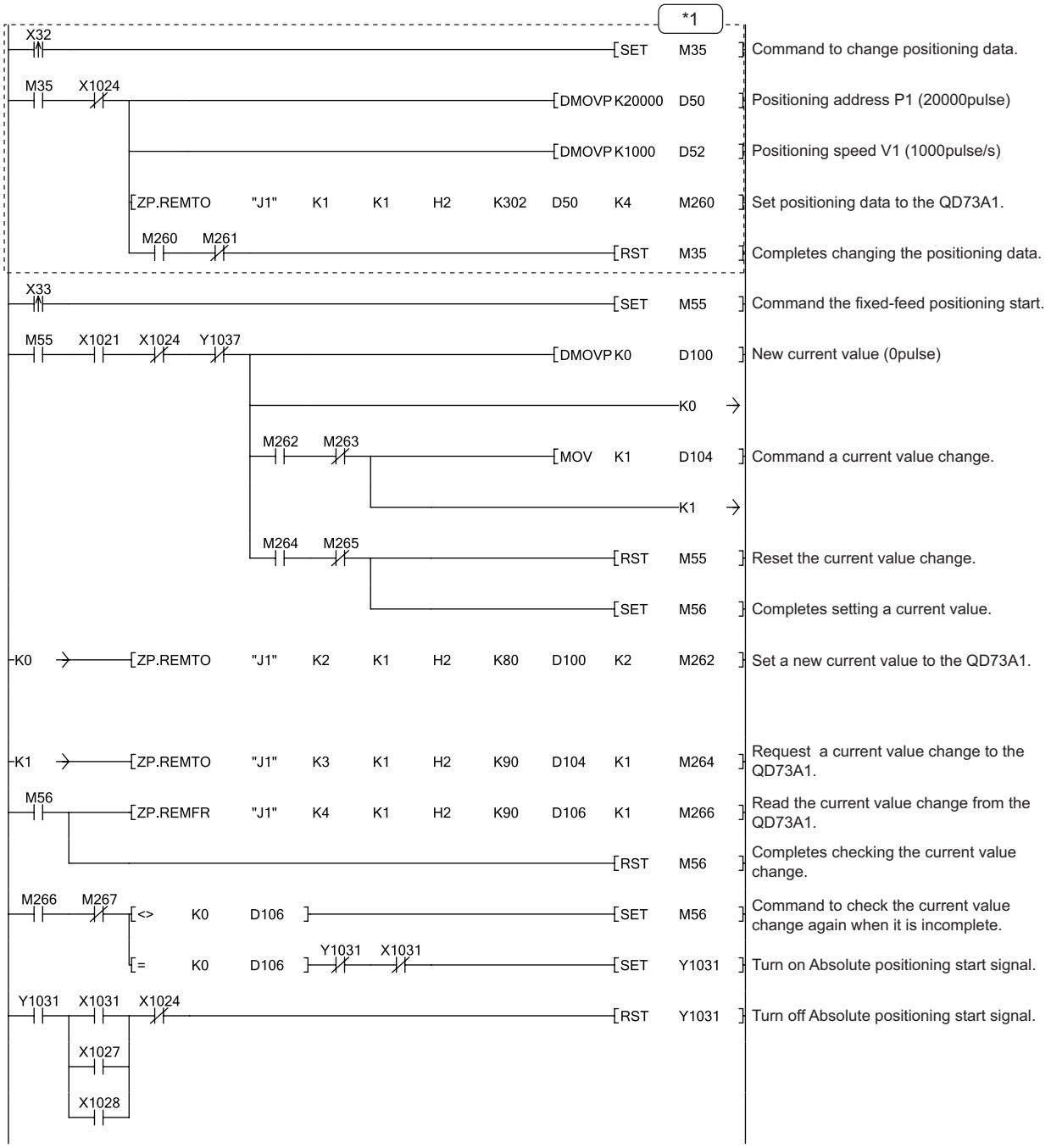
## (2) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | QD73A1 READY signal (X1021) | ON | — |
| | BUSY signal (X1024) | OFF | |
| | Excessive error signal (X1027) | OFF | |
| | Error detection signal (X1028) | OFF | |
| | Absolute positioning start complete signal (X1031) | OFF | |
| | Synchronization flag (X1034) | ON | |
| | Absolute positioning start signal (Y1031) | OFF | |
| | Stop signal (Y1037) | OFF | |
| | PLC READY signal (Y103D) | ON | |
| Buffer memory | Positioning data | No error | When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value". |

### (3) Device used by the user

| Device | Description |
|---|---|
| X32 | Fixed-feed positioning data write command |
| X33 | Fixed-feed start command |
| D50 | Positioning address P1 (lower 16 bits) |
| D51 | Positioning address P1 (upper 16 bits) |
| D52 | Positioning speed V1 (lower 16 bits) |
| D53 | Positioning speed V1 (upper 16 bits) |
| D100 | New current value (lower 16 bits) |
| D101 | New current value (upper 16 bits) |
| D104 | Current value change request |
| D106 | Current value change result check |
| M35 | Variable parameter change |
| M55 | Fixed-feed positioning data write command pulse |
| M56 | Current value change result reading |
| M260 | Z(P).REMTO instruction completion |
| M261 | Z(P).REMTO instruction failure |
| M262 | Z(P).REMTO instruction completion |
| M263 | Z(P).REMTO instruction failure |
| M264 | Z(P).REMTO instruction completion |
| M265 | Z(P).REMTO instruction failure |
| M266 | Z(P).REMFR instruction completion |
| M267 | Z(P).REMFR instruction failure |

## (4) Program example




*1 Positioning data can be set through GX Works2 also. (☞ Page 107, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

# 7.4.5 JOG operation program

This program executes JOG operation while a JOG start command is on. Suppose that parameters are already set. (☞Page 147, Section 7.4.1)

## (1) Program detail

- As X34 is turned on, JOG speed is written.

| Item | Setting detail |
|---|---|
| Cd.3 JOG speed | 10000pulse/s |

- As X35 is turned on, the module executes forward JOG operation. As X36 is turned on, the module executes reverse JOG operation.

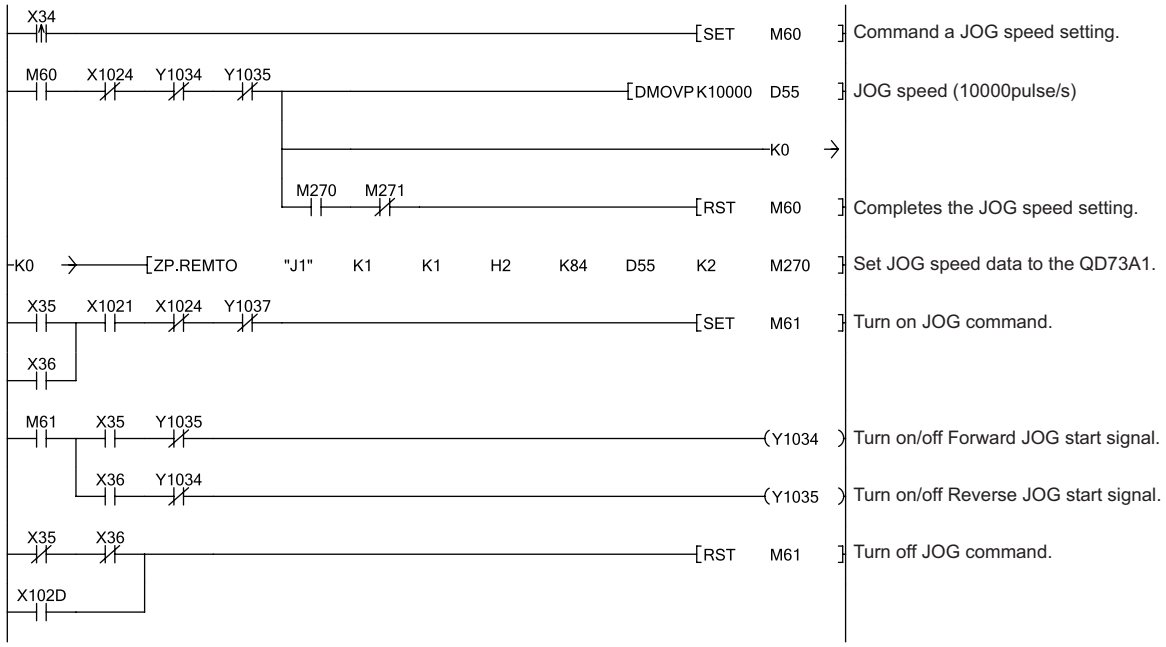
## (2) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | QD73A1 READY signal (X1021) | ON | — |
| | BUSY signal (X1024) | OFF | |
| | External stop signal (X102D) | OFF | |
| | Synchronization flag (X1034) | ON | |
| | Forward JOG start signal (Y1034) | OFF | |
| | Reverse JOG start signal (Y1035) | OFF | |
| | Stop signal (Y1037) | OFF | |
| | PLC READY signal (Y103D) | ON | |
| Buffer memory | Cd.3 JOG speed | No error | When "Cd.3 JOG speed" is set exceeding "Pr.5 Speed limit value", the operation is executed at "Pr.5 Speed limit value". |

## (3) Device used by the user

| Device | Description |
|---|---|
| X34 | JOG speed write command |
| X35 | Forward JOG command |
| X36 | Reverse JOG command |
| D55 | JOG speed (lower 16 bits) |
| D56 | JOG speed (upper 16 bits) |
| M60 | JOG speed writing |
| M61 | JOG command |
| M270 | Z(P).REMTO instruction completion |
| M271 | Z(P).REMTO instruction failure |

## (4) Program example



# 7.4.6 Control change program

## (1) Current value change program

This program changes the current value to "0".

### (a) Program detail

As X37 is turned on, the current value is changed.

| Item | Setting detail |
|---|---|
| Cd.1 New current value | 0pulse |

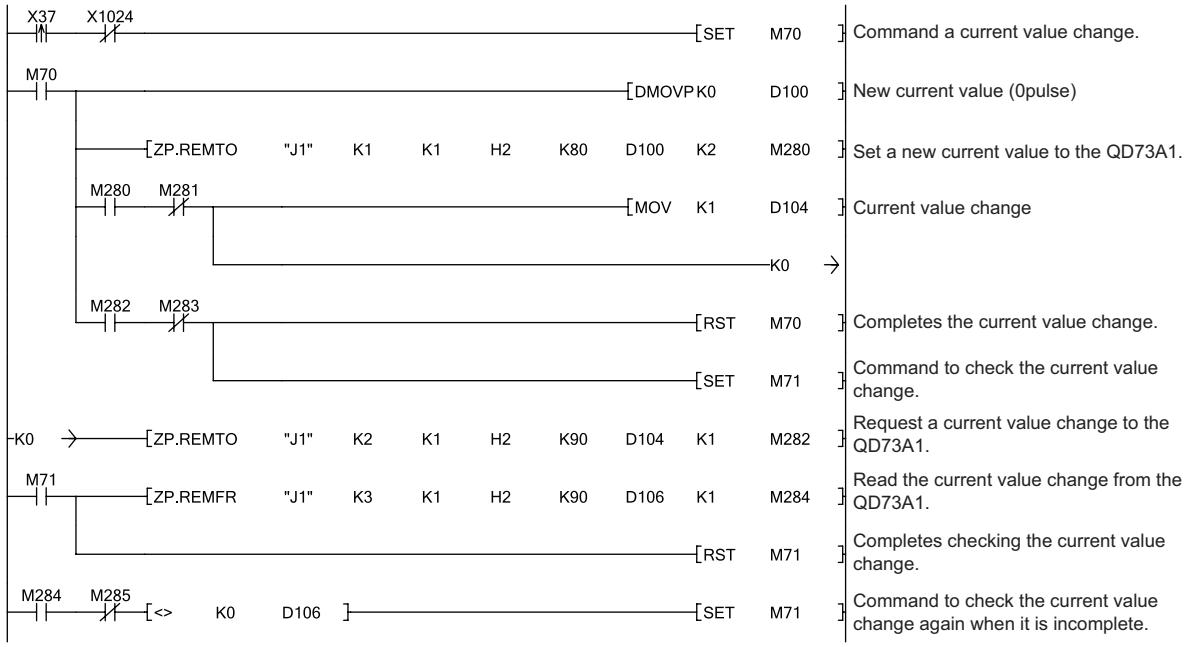
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| I/O signal | WDT error, H/W error signal (X1020) | OFF | — |
| | BUSY signal (X1024) | OFF | |
| | Error detection signal (X1028) | OFF | |
| | Synchronization flag (X1034) | ON | |

### (c) Device used by the user

| Device | Description |
|---|---|
| X37 | Current value change command |
| D100 | New current value (lower 16 bits) |
| D101 | New current value (upper 16 bits) |
| D104 | Current value change request |
| D106 | Current value change result check |
| M70 | Variable parameter change |
| M71 | Positioning data change |
| M280 | Z(P).REMTO instruction completion |
| M281 | Z(P).REMTO instruction failure |
| M282 | Z(P).REMTO instruction completion |
| M283 | Z(P).REMTO instruction failure |
| M284 | Z(P).REMFR instruction completion |
| M285 | Z(P).REMFR instruction failure |

### (d) Program example



## (2) Speed change program

This program changes positioning speed.

### (a) Program detail

As X38 is turned on, positioning speed is changed.

| Item | Setting detail |
|---|---|
| Cd.2 New speed value | 50000pulse/s |

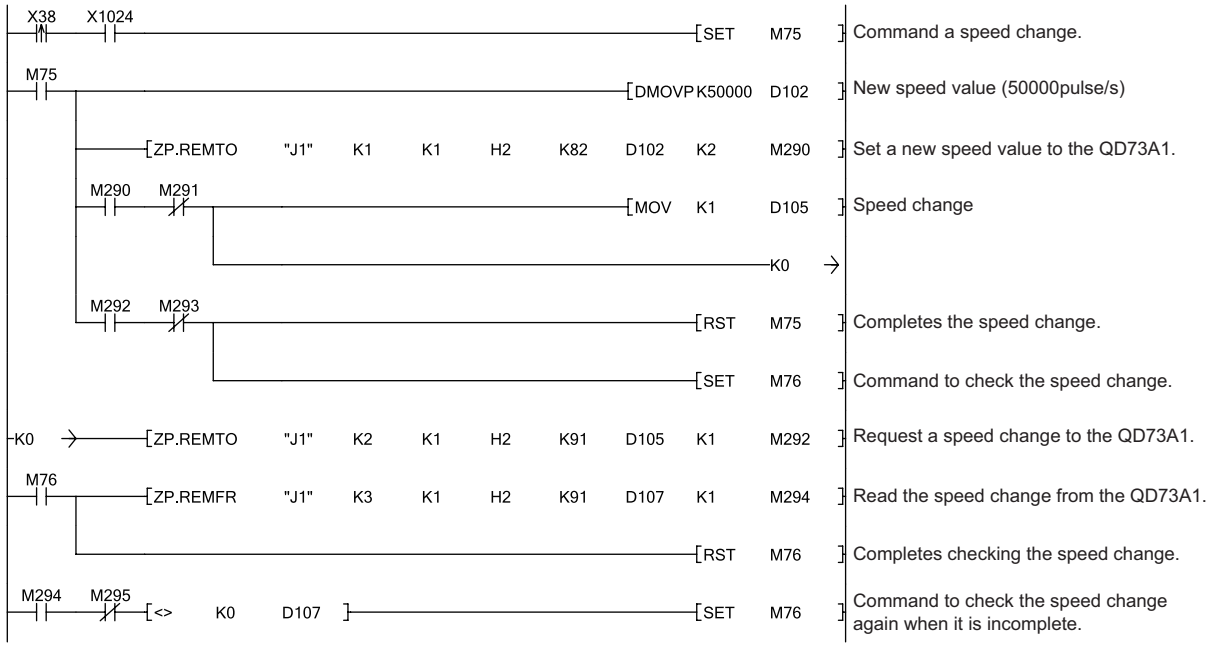
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| External I/O signal | Servo READY signal (READY) | ON | — |
| | Stop signal (STOP) | OFF | |
| | Upper limit signal (FLS) | ON | |
| | Lower limit signal (RLS) | ON | |
| I/O signal | WDT error, H/W error signal (X1020) | OFF | — |
| | QD73A1 READY signal (X1021) | ON | |
| | BUSY signal (X1024) | ON | |
| | Excessive error signal (X1027) | OFF | |
| | Error detection signal (X1028) | OFF | |
| | Synchronization flag (X1034) | ON | |
| | Stop signal (Y1037) | OFF | |
| | PLC READY signal (Y103D) | ON | |
| Buffer memory | Cd.2 New speed value | No error | When " Cd.2 New speed value" is set exceeding " Pr.5 Speed limit value", the operation is executed at " Pr.5 Speed limit value". |

### (c) Device used by the user

| Device | Description |
|---|---|
| X38 | Speed change command |
| D102 | New speed value (lower 16 bits) |
| D103 | New speed value (upper 16 bits) |
| D105 | Speed change request |
| D107 | Speed change result check |
| M75 | Speed change |
| M76 | Speed change request check |
| M290 | Z(P).REMTO instruction completion |
| M291 | Z(P).REMTO instruction failure |
| M292 | Z(P).REMTO instruction completion |
| M293 | Z(P).REMTO instruction failure |
| M294 | Z(P).REMFR instruction completion |
| M295 | Z(P).REMFR instruction failure |

### (d) Program example



## (3) Deviation counter clearing program

This program clears the deviation counter to 0.

### (a) Program detail

As X39 is turned on, the deviation counter is cleared to 0.

| Item | Setting detail |
|---|---|
| Cd.4 Deviation counter clear command | 1: Clear the deviation counter |

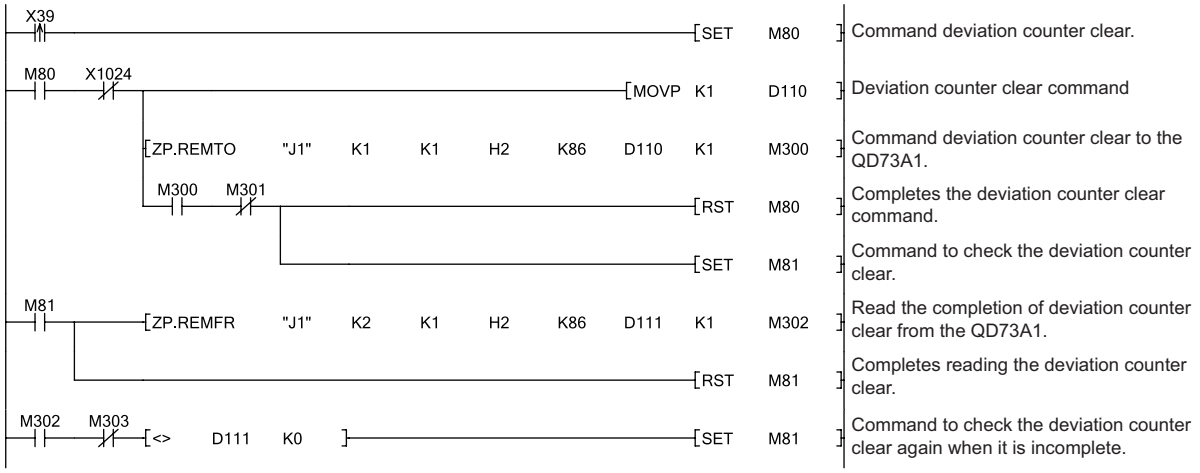
### (b) Execution condition

| Check item | | Condition | Note |
|---|---|---|---|
| I/O signal | WDT error, H/W error signal (X1020) | OFF | — |
| | BUSY signal (X1024) | OFF | |
| | Error detection signal (X1028) | OFF | |
| | Synchronization flag (X1034) | ON | |

### (c) Device used by the user

| Device | Description |
|---|---|
| X39 | Deviation counter clear command |
| D110 | Deviation counter clear request |
| D111 | Deviation counter clearing result check |
| M80 | Deviation counter clear |
| M81 | Deviation counter clearing completion check |
| M300 | Z(P).REMTO instruction completion |
| M301 | Z(P).REMTO instruction failure |
| M302 | Z(P).REMFR instruction completion |
| M303 | Z(P).REMFR instruction failure |

### (d) Program example


X39
SET M80
Command deviation counter clear.
M80 X1024
MOVP K1 D110
Deviation counter clear command
ZP.REMTO "J1" K1 K1 H2 K86 D110 K1 M300
Command deviation counter clear to the QD73A1.
M300 M301
RST M80
Completes the deviation counter clear command.
SET M81
Command to check the deviation counter clear.
M81
ZP.REMFR "J1" K2 K1 H2 K86 D111 K1 M302
Read the completion of deviation counter clear from the QD73A1.
RST M81
Completes reading the deviation counter clear.
M302 M303
<> D111 K0
SET M81
Command to check the deviation counter clear again when it is incomplete.

# 7.4.7 Stop program during positioning

This program stops the positioning in execution.

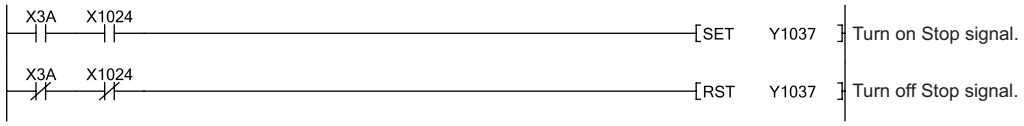
### (a) Program detail

As X3A is turned on, the module stops the positioning in execution.

### (b) Device used by the user

| Device | Description |
|---|---|
| X3A | Stop command |

### (c) Program example



# CHAPTER 8 OPR CONTROL

This chapter describes OPR control.

## 8.1 Overview of OPR Control

In "OPR control", a starting point (or OP) of major positioning control is set, and positioning is executed toward the original point. Use this control to return a machine system at a position other than its OP to the OP when the QD73A1 turned on OPR request signal (X12) at power-on, or after a positioning stop.
OPR request signal (X12) turns on at the following timings.

- When the power is turned on
- When the CPU module was reset
- When OPR starts
- When Servo READY signal (READY) turns off while BUSY signal (X14) is on

### (1) OPR method

The QD73A1 has two OPR methods so that an OP can be established in the optimum method (determination of the OP position, or OPR completion) depending on the positioning system configuration or the application.
Set an OPR method in the switch setting. For the setting method, refer to the following.
☞Page 101, Section 6.2

| OPR method | Operation detail | Reference |
|---|---|---|
| Near-point dog method | As the near-point dog turns on, deceleration starts. (The speed decelerates to " Pr.12 Creep speed".) After the near-point dog turned off, the OPR is completed at the operation stop with the first Zero signal*1, specifying the position as the OP. | Page 177, Section 8.2 |
| Count method | As the near-point dog turns on, deceleration starts and the machine moves at " Pr.12 Creep speed". From the position where the near-point dog turned on, the machine moves the distance set in " Pr.13 Setting for the movement amount after near-point dog ON". Then, the OPR is completed at the operation stop with the first Zero signal*1. | Page 179, Section 8.3 |

*1 Signal that is output as a single pulse at one motor revolution (e.g. Z-phase signal output from the drive unit)

### (2) External I/O signals used for OPR control

◎: Necessary ○: Necessary as required

| OPR method | Signal required for control | | |
|---|---|---|---|
| | Near-point dog signal (DOG) | Zero signal | Upper limit signal (FLS)/Lower limit signal (RLS) |
| Near-point dog method | ◎ | ◎ | ○ |
| Count method | ◎ | ◎ | ○ |

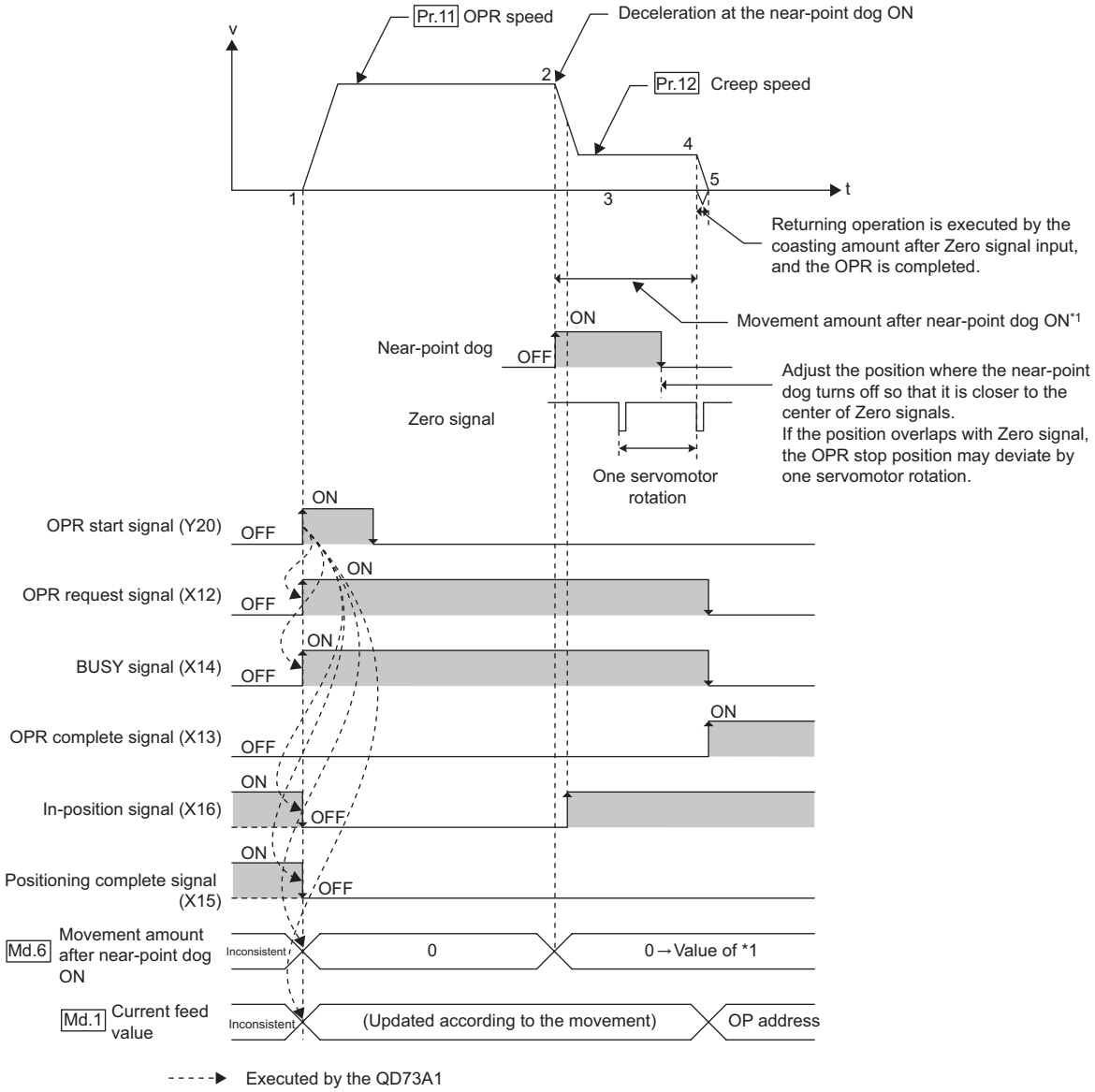
# 8.2 Near-point Dog Method

This section describes the operation overview of an OPR method, "near-point dog method".

## (1) Operation chart

| | |
|---|---|
| 1 | OPR starts.<br>(Acceleration starts in the direction set on "OPR direction setting" in the switch setting, and the machine moves at " Pr.11 OPR speed".) |
| 2 | As the near-point dog turns on, deceleration starts. |
| 3 | The machine decelerates to " Pr.12 Creep speed", and subsequently moves at the creep speed.<br>(The near-point dog must be on during the deceleration. If the near-point dog turns off during the deceleration, the OPR is completed at the first Zero signal input after the near-point dog OFF.) |
| 4 | Output from the QD73A1 stops at the first Zero signal after the near-point dog OFF. |
| 5 | Returning operation is executed by the coasting amount after Zero signal input, then OPR complete signal (X13) turns on and OPR request signal (X12) turns off. |

As in the following figure, after the near-point dog turned off, the position of the first Zero signal from the pulse generator becomes the OP.


Pr.11 OPR speed
Deceleration at the near-point dog ON
Pr.12 Creep speed
v
t
1
2
3
4
5
Returning operation is executed by the coasting amount after Zero signal input, and the OPR is completed.
Movement amount after near-point dog ON*1
Near-point dog
ON
OFF
Zero signal
Adjust the position where the near-point dog turns off so that it is closer to the center of Zero signals.
If the position overlaps with Zero signal, the OPR stop position may deviate by one servomotor rotation.
One servomotor rotation
OPR start signal (Y20)
OPR request signal (X12)
BUSY signal (X14)
OPR complete signal (X13)
In-position signal (X16)
Positioning complete signal (X15)
Md.6 Movement amount after near-point dog ON
Md.1 Current feed value
Inconsistent
0
0→Value of *1
(Updated according to the movement)
OP address
Executed by the QD73A1

## (2) Precautions during operation

### (a) Another OPR after the completion of OPR

If another OPR is attempted after the completion of OPR, the error "OPR complete signal ON at start" (error code: 84) occurs.

### (b) Positions of the near-point dog OFF and Zero signal

If the position where the near-point dog turns off is close to Zero signal, the Zero signal may be misread, resulting in deviation of OP by one servomotor rotation. Adjust the position where the near-point dog turns off so that it becomes closer to the center of Zero signals.

### (c) OPR start from the near-point dog ON position

If an OPR start is attempted from the near-point dog ON position, the error "Near-point dog signal ON at start" (error code: 74) occurs.
Return the workpiece to a position away from the near-point dog using JOG operation, then execute OPR.

### (d) Another OPR after the reset of the CPU module

If the CPU module was reset after OPR control was completed and the near-point dog turned off, another OPR can be started; however, the operation is executed at "Pr.11 OPR speed" to the position of the upper limit switch (FLS) or the lower limit switch (RLS) since there is no near-point dog placed in the OPR direction.

### (e) Outside the stroke limit range

If the workpiece moved outside the stroke limit range, the error "Outside the stroke limit range" (error code: 100) occurs; although, the operation continues. In this case, the OPR is completed normally if the near-point dog is placed on the OPR direction.

# 8.3 Count Method

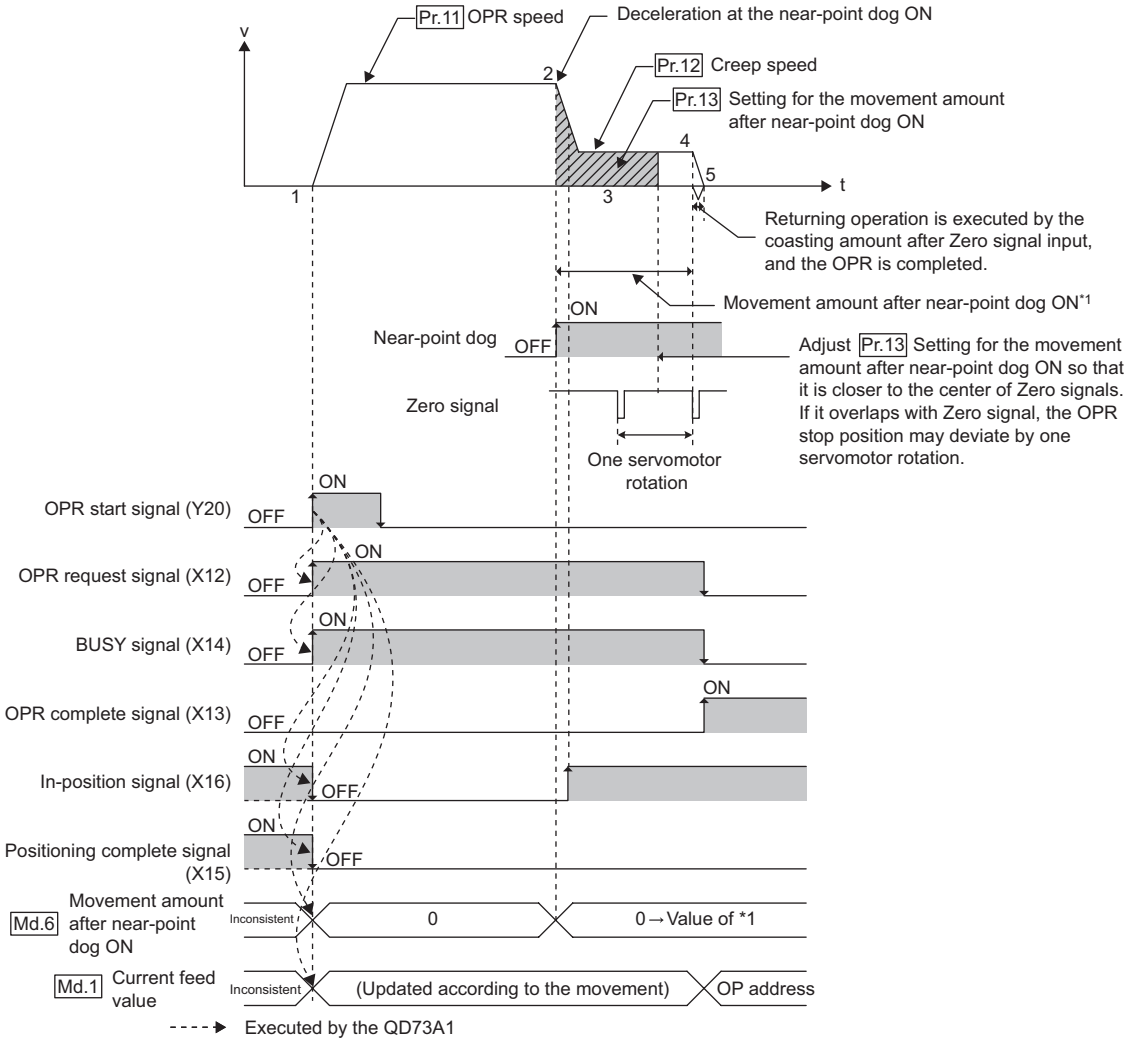
This section describes the operation overview of an OPR method, "count method".
OPR in the count method can be executed also in case of the following.

- OPR on the near-point dog ON
- Another OPR after completion of OPR

## (1) Operation chart

| | |
|---|---|
| 1 | OPR starts.<br>(Acceleration starts in the direction set on "OPR direction setting" in the switch setting, and the machine moves at "Pr.11 OPR speed".) |
| 2 | As the near-point dog turns on, deceleration starts. |
| 3 | The machine decelerates to "Pr.12 Creep speed", and subsequently moves at the creep speed. |
| 4 | Output from the QD73A1 stops at the first Zero signal after the machine moved by the amount set in "Pr.13 Setting for the movement amount after near-point dog ON". |
| 5 | Returning operation is executed by the coasting amount after Zero signal input, then OPR complete signal (X13) turns on and OPR request signal (X12) turns off. |

As in the following figure, after the machine moved the amount set in "Pr.13 Setting for the movement amount after near-point dog ON", the position of the first Zero signal from the pulse generator becomes the OP.


Pr.11 OPR speed
Deceleration at the near-point dog ON
Pr.12 Creep speed
Pr.13 Setting for the movement amount after near-point dog ON
v
t
1
2
3
4
5
Returning operation is executed by the coasting amount after Zero signal input, and the OPR is completed.
Movement amount after near-point dog ON*1
Near-point dog
Zero signal
ON
OFF
Adjust Pr.13 Setting for the movement amount after near-point dog ON so that it is closer to the center of Zero signals. If it overlaps with Zero signal, the OPR stop position may deviate by one servomotor rotation.
One servomotor rotation
OPR start signal (Y20)
OPR request signal (X12)
BUSY signal (X14)
OPR complete signal (X13)
In-position signal (X16)
Positioning complete signal (X15)
Md.6 Movement amount after near-point dog ON
Md.1 Current feed value
Inconsistent
0
0→Value of *1
(Updated according to the movement)
OP address
Executed by the QD73A1

## (2) Precautions during operation

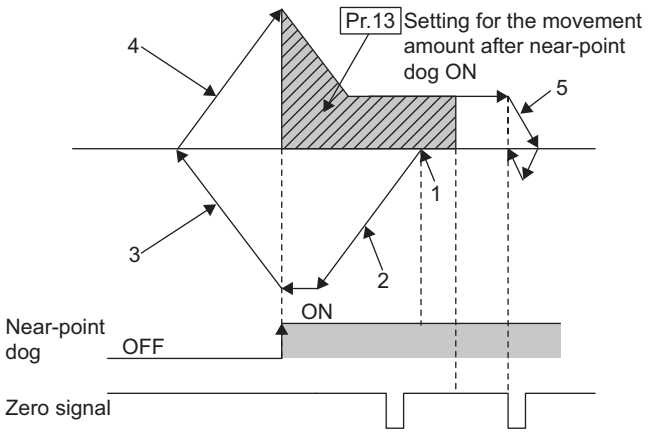
### (a) Pr.13 Setting for the movement amount after near-point dog ON

If "Pr.13 Setting for the movement amount after near-point dog ON" is smaller than the deceleration distance from "Pr.11 OPR speed" to "Pr.12 Creep speed", the error "Setting for the movement amount after near-point dog ON Outside the setting range" (error code: 22) occurs, and the OPR does not start.

In addition, if the position after the move according to "Pr.13 Setting for the movement amount after near-point dog ON" is close to Zero signal, the Zero signal may be misread, resulting in deviation of OP by one servomotor rotation. Set "Pr.13 Setting for the movement amount after near-point dog ON" so that the position after the move becomes closer to the center of Zero signals.

### (b) OPR start while near-point dog is on

The operation is as follows.



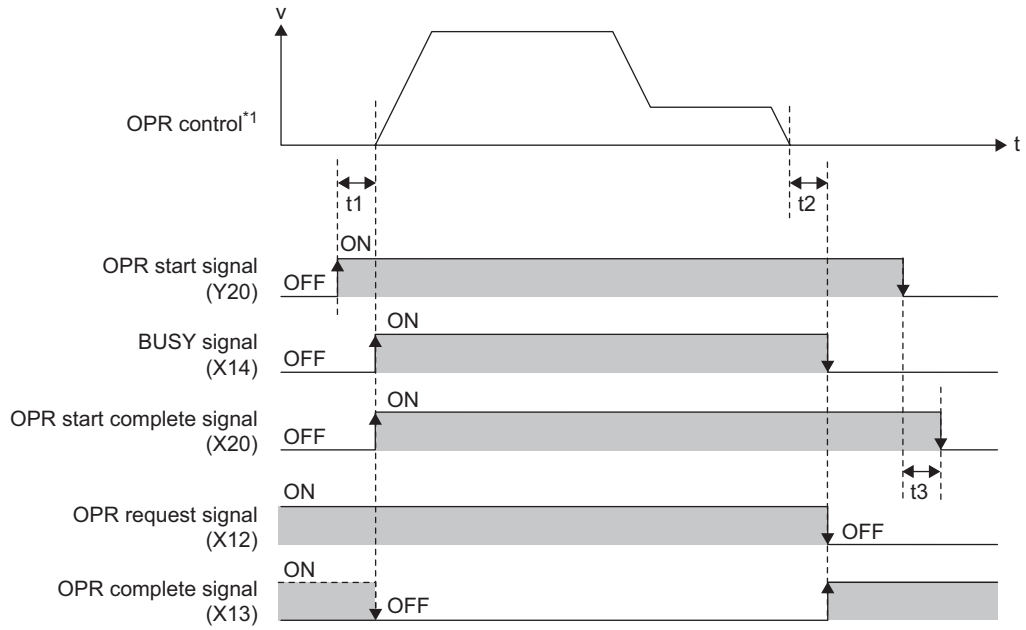

| | |
|---|---|
| 1 | OPR starts. |
| 2 | The workpiece moves in the direction that is opposite from the specified OPR direction at "Pr.11 OPR speed". |
| 3 | As the near-point dog turns off, deceleration starts. |
| 4 | After an operation stop, OPR starts in the specified OPR direction. |
| 5 | As the near-point dog turns on, the workpiece moves the amount set in "Pr.13 Setting for the movement amount after near-point dog ON". Then, the OPR is completed at the first Zero signal after the move. |

### (c) Outside the stroke limit range

If the workpiece moved outside the stroke limit range, the error "Outside the stroke limit range" (error code: 100) occurs; although, the operation continues. In this case, the OPR is completed normally if the near-point dog is placed on the OPR direction.

# 8.4 Operation Timing and Processing Time of OPR Control

This section explains the operation timing and processing time of OPR control.




*1 This is an indication of internal commands, and does not match with the actual analog output waveform.

The following values apply to t1 to t3.

| t1 | t2 | t3 |
|---|---|---|
| 0.7 to 1.2ms | 0 to 0.5ms | 0 to 0.5ms |

# 8.5 OPR Parameter Setting

For the QD73A1 to execute OPR, OPR parameters must be set. If the data are not set, default values are used for control.
The default values are set also when the power was turned off and on, or when the CPU module was reset.
The following table lists the OPR parameters to be set, setting condition, and check timing.

| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Pr.10 | OP address | -2147483648 to 2147483647 pulse | 0 pulse | PLC READY signal (Y2D) must be off. | When OPR start signal (Y20) is turned on | 40<br>41 |
| Pr.11 | OPR speed | 1 to 4000000pulse/s | 10000pulse/s | | | 42<br>43 |
| Pr.12 | Creep speed | 1 to 4000000pulse/s | 1000pulse/s | | | 44<br>45 |
| Pr.13 | Setting for the movement amount after near-point dog ON (set only for the count method) | 0 to 2147483647pulse | 75 pulse | | | 46<br>47 |

# CHAPTER 9 MAJOR POSITIONING CONTROL



"Major positioning control" is executed using "variable parameters" and "positioning data" stored in the QD73A1. The position control mode or the speed-position control switch mode is executed by setting a variable parameter " Pr.9 Positioning mode" and a positioning data item " Da.1 Positioning pattern" and by starting the positioning data.

## 9.1 Overview of Major Positioning Control

The following types of "major positioning control" are executed when a positioning start signal (Y21 to Y23) is turned on.

| Major positioning control | | Start signal | Description | Reference |
|---|---|---|---|---|
| Position control mode | Positioning control | • Absolute positioning start signal (Y21)<br>• Forward start signal (Y22) (incremental positioning)<br>• Reverse start signal (Y23) (incremental positioning) | Positioning is executed from the current position to a specified position at a specified speed.<br>[Buffer memory setting]<br>• Pr.9 Positioning mode: 0<br>• Da.1 Positioning pattern: 0 | Page 189, Section 9.6.1 (1) |
| | Two-phase trapezoidal positioning control | | Positioning is executed to the address specified with " Da.2 Positioning address P1" at " Da.3 Positioning speed V1", then to the address specified with " Da.4 Positioning address P2" at " Da.5 Positioning speed V2" by one positioning start signal.<br>[Buffer memory setting]<br>• Pr.9 Positioning mode: 0<br>• Da.1 Positioning pattern: 1 | Page 190, Section 9.6.1 (2) |
| Speed-position control switch mode | | • Forward start signal (Y22) (Speed-position control switchover)<br>• Reverse start signal (Y23) (Speed-position control switchover) | Operation starts according to the positioning speed set beforehand by one positioning start signal, then the operation switches to position control by Speed-position switching command signal (CHANGE).<br>If the operation stopped by Stop signal after the input of Speed-position switching command signal (CHANGE), the positioning can be continued by requesting a restart.<br>In addition, the positioning address (movement amount) can be changed if it is before the input of Speed-position switching command signal (CHANGE).<br>[Buffer memory setting]<br>• Pr.9 Positioning mode: 1<br>• Da.1 Positioning pattern: 0 | Page 193, Section 9.6.2 |

# 9.2 Data Required for Major Positioning Control

This section describes "positioning data" required for "major positioning control".

## (1) Composition of positioning data and setting details

| Positioning data | | Setting detail |
|---|---|---|
| Da.1 | Positioning pattern | Select a control pattern of major positioning from "positioning control" or "two-phase trapezoidal positioning control". |
| Da.2 | Positioning address P1 | Set the address that is the destination of major positioning control. |
| Da.3 | Positioning speed V1 | Set the command speed of major positioning control. |
| Da.4 | Positioning address P2 | In two-phase trapezoidal positioning control, set the destination address of after the move to the address set to " Da.2 Positioning address P1". |
| Da.5 | Positioning speed V2 | In two-phase trapezoidal positioning control, set the command speed to move to the address set to " Da.4 Positioning address P2". |

The settings of Da.1 to Da.5 depend on " Pr.9 Positioning mode" and " Da.1 Positioning pattern".
(☞ Page 185, Section 9.3)

## (2) Sub functions for major positioning control

For details on "sub functions" that can be combined with major positioning control, refer to the following.
☞ Page 30, Section 3.3 (4)
For details on each sub function, refer to the following.
☞ Page 206, CHAPTER 11

# 9.3 Relation Between Each Control and Positioning Data



Setting items and details of positioning data depend on the settings of a positioning data item "Da.1 Positioning pattern" and a variable parameter "Pr.9 Positioning mode".
The following table shows the positioning data setting items for each type of control.

| Positioning data | | | Settings of "Pr.9 Positioning mode" | |
|---|---|---|---|---|
| | | | 0: Position control mode | 1: Speed-position control switch mode |
| Da.1 | Positioning pattern | 0: Positioning control | ◎ | — |
| | | 1: Two-phase trapezoidal positioning control | ◎ | — |
| Da.2 | Positioning address P1 | | ◎ | ◎ |
| Da.3 | Positioning speed V1 | | ◎ | ◎ |
| Da.4 | Positioning address P2 | | ○ | — |
| Da.5 | Positioning speed V2 | | ○ | — |

◎: Set always
○: Set only for two-phase trapezoidal positioning control
—: Setting not required (The setting is ignored. Use the default value or a value that does not cause an error.)

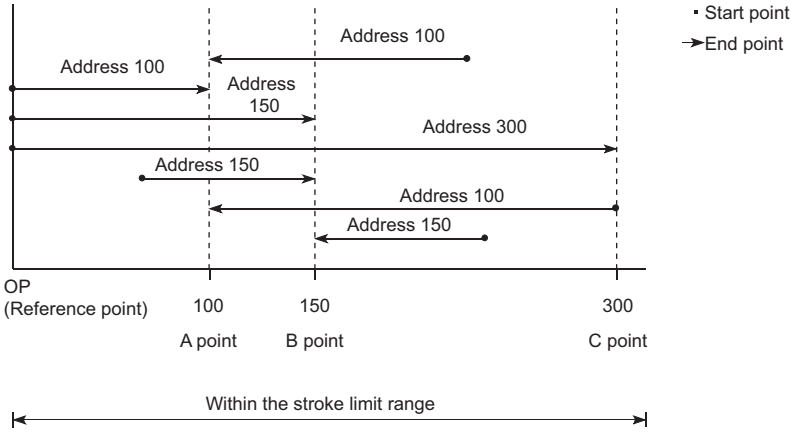
For details on each control and setting, refer to the following.
☞Page 188, Section 9.6

# 9.4 Specifying a Positioning Address

This section describes systems to specify a position for control using positioning data.

## (1) Absolute system

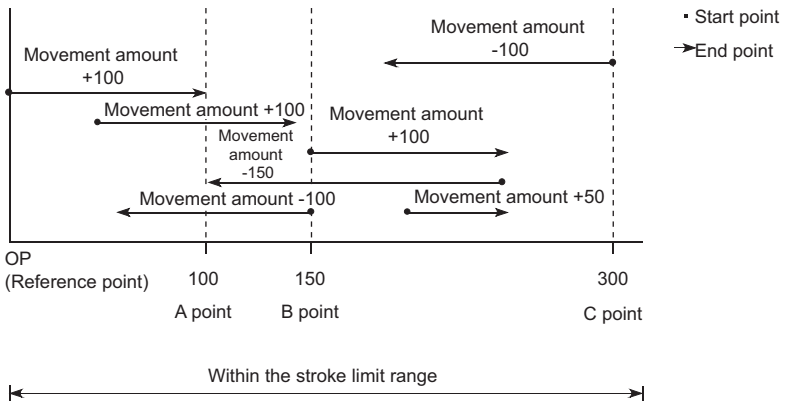
Positioning is executed using the current address as the start address and the address set with "Da.2 Positioning address P1" as the end address.




## (2) Incremental system

Positioning is executed from the current address (start address) by the movement amount set in "Da.2 Positioning address P1".

The moving direction depends on the start signal to turn on: Forward start signal (Y22) or Reverse start signal (Y23).



# 9.5 Checking the Current Value

In the QD73A1, two types of address are used to indicate position.

## (1) Addresses to be used

The two types of address, "current feed value" and "actual current value", are stored to the monitor data area. They can be monitored when necessary.

| Item | Description | Update cycle |
|---|---|---|
| Current feed value | • This is the value stored in " Md.1 Current feed value".<br>• The address established through OPR is the value of reference.<br>• The address can be changed through a current value change. | 0.5ms |
| Actual current value | • This is the value stored in " Md.2 Actual current value".<br>• The actual servomotor movement amount calculated based on feedback pulses is stored as an actual current value (the number of feedback pulses).<br>(Actual current value = Current feed value - Accumulated pulses in the deviation counter) | |

## (2) Precaution

When the value stored in " Md.1 Current feed value" or " Md.2 Actual current value" is used for control, the update timing of the buffer memory area may be in error by 0.5ms.

# 9.6 Details of Major Positioning Control

This section describes details on the position control mode (positioning control and two-phase trapezoidal positioning control) and the speed-position control switch mode.

## (1) Precautions

### (a) Dwell-time function

The QD73A1 does not have the dwell-time function. When dwell-time is necessary, start the next operation using the timer in the sequence program once the specified period of time passed after Positioning complete signal (X15) turned on.

### (b) Combined use of incremental system and absolute system

The QD73A1 controls the current value during positioning. If incremental system positioning or combined positioning of incremental system and absolute system is repeated, the workpiece may move outside the stroke limit range and an error may occur. If an error occurs, change the current value to the one within the stroke limit range.

## (2) Stop and restart during positioning

Refer to the following.

☞Page 228, CHAPTER 12

# 9.6.1 Position control mode

In the position control mode, positioning is executed toward the positioning address specified with positioning data at the specified speed.

There are two types of control in the position control mode.

- Positioning control (☞Page 189, Section 9.6.1 (1))
- Two-phase trapezoidal positioning control (☞Page 190, Section 9.6.1 (2))

There are two systems to specify a positioning address: the absolute system in which a positioning end address is specified and the incremental system in which movement amount from a start address to an end address is specified.

Specify the absolute system or the incremental system using one of the following start signals.

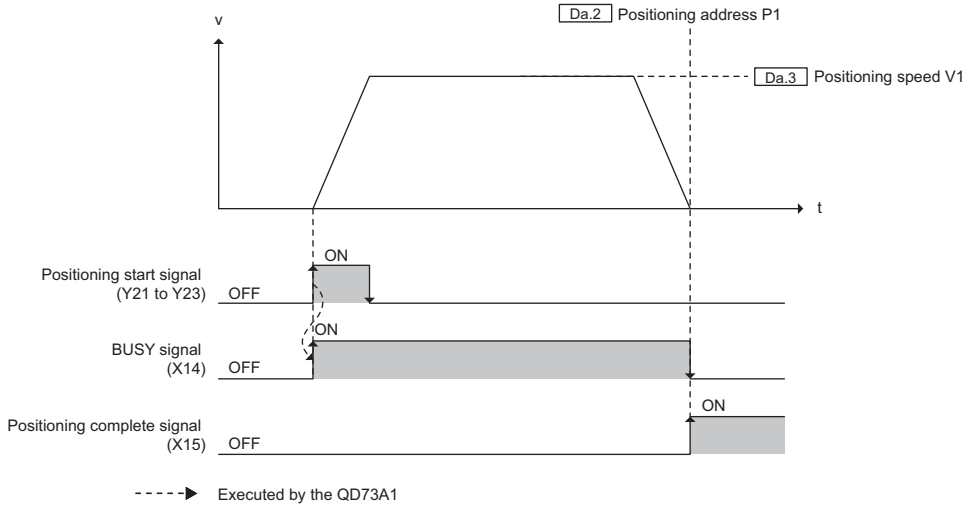
| Start signal | Positioning system |
|---|---|
| Absolute positioning start signal (Y21) | Positioning start in the absolute system |
| Forward start signal (Y22) | Forward start in the incremental system (address increasing) |
| Reverse start signal (Y23) | Reverse start in the incremental system (address decreasing) |

## (1) Positioning control

Set a positioning address and positioning speed for this type of control. Absolute system positioning or incremental system positioning is executed by a positioning start command.

### (a) Operation of positioning control

The operation is as follows.



### (b) Positioning data setting

The following table lists the positioning data to be set, setting condition, and check timing.

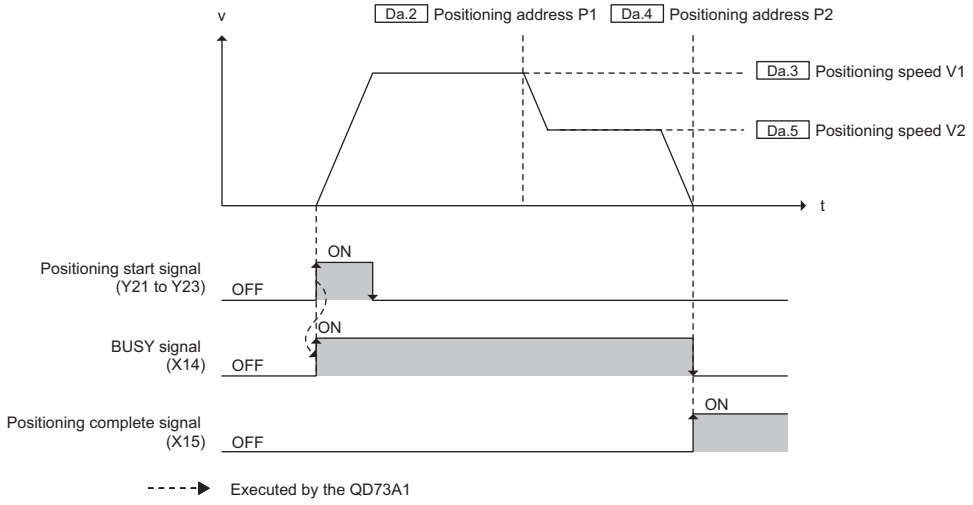
| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Da.1 | Positioning pattern | 0: Positioning control<br>1: Two-phase trapezoidal positioning control | 0 | The data can be set anytime. Note that the set data at the rise (ON) of a positioning start signal (Y21 to Y23) are used for the operation. If the data are written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next positioning start signal (Y21 to Y23). | When a positioning start signal (Y21 to Y23) is turned on | 301 |
| Da.2 | Positioning address P1 (movement amount for the incremental system) | Absolute system:<br>-2147483648 to 2147483647pulse<br>Incremental system:<br>0 to 2147483647pulse | 0pulse | | | 302<br>303 |
| Da.3 | Positioning speed V1 | 1 to 4000000pulse/s | 0pulse/s | | | 304<br>305 |

## (2) Two-phase trapezoidal positioning control

Set positioning addresses (P1 and P2) and positioning speed (V1 and V2) for this type of control. Positioning of the absolute system or the incremental system is executed first to the positioning address P1 at the positioning speed V1, then to the positioning address P2 at the positioning speed V2 by one positioning start command.

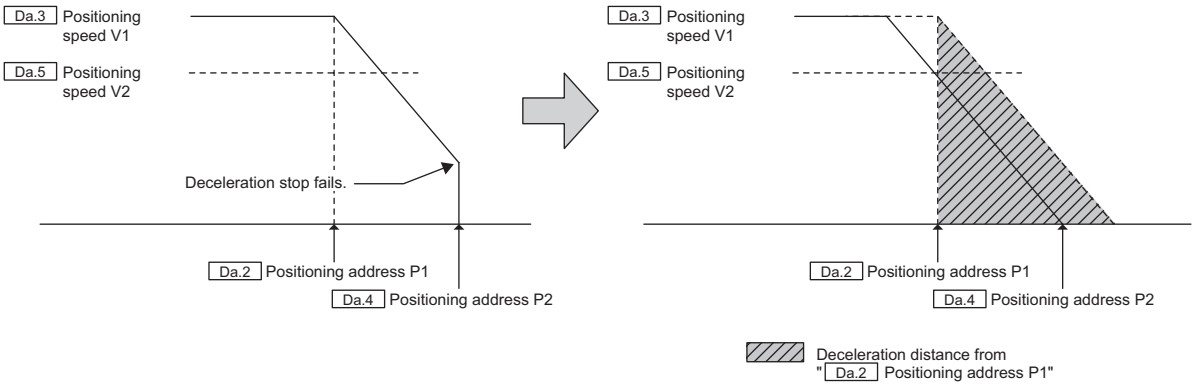
### (a) Operation of two-phase trapezoidal positioning control

The operation is as follows.



### (b) Deceleration distance

If the movement amount from the positioning address P1 to the positioning address P2 is less than the deceleration distance from the positioning address P1, two-phase trapezoidal positioning control is not formed. In this case, the deceleration from the positioning speed V1 starts before the workpiece reaches the positioning address P1 so that the operation stops at the positioning address P2.


Da.3 Positioning speed V1
Da.5 Positioning speed V2
Deceleration stop fails.
Da.2 Positioning address P1
Da.4 Positioning address P2
Da.3 Positioning speed V1
Da.5 Positioning speed V2
Da.2 Positioning address P1
Da.4 Positioning address P2
Deceleration distance from "Da.2 Positioning address P1"

To execute two-phase trapezoidal positioning, set the positioning data so that the deceleration distance from the positioning address P1 does not exceed the movement amount from the positioning address P1 to the positioning address P2.

### (c) Two-phase trapezoidal positioning control in the absolute system

To execute two-phase trapezoidal positioning control in the absolute system, the positioning direction from "Da.2 Positioning address P1" to "Da.4 Positioning address P2" and the positioning direction from the current value to "Da.2 Positioning address P1" must be the same.
If not, the error "Two-phase trapezoidal positioning address error" (error code: 31) occurs, and the two-phase trapezoidal positioning control does not start.

| Setting example | | Moving direction from the current value to the positioning address P1 | |
|---|---|---|---|
| Da.2 Positioning address P1 | Da.4 Positioning address P2 | Address increasing direction | Address decreasing direction |
| 10000 | 5000 | Error | Positioning executed |
| 10000 | 15000 | Positioning executed | Error |

### (d) Positioning speed V1 and V2

Any value within the setting range can be set in "Da.3 Positioning speed V1" and "Da.5 Positioning speed V2" regardless the relation between the two setting values.

### (e) Positioning data setting

The following table lists the positioning data to be set, setting condition, and check timing.

| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Da.1 | Positioning pattern | 0: Positioning control<br>1: Two-phase trapezoidal positioning control | 0 | The data can be set anytime. Note that the set data at the rise (ON) of a positioning start signal (Y21 to Y23) are used for the operation. If the data are written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next positioning start signal (Y21 to Y23). | When a positioning start signal (Y21 to Y23) is turned on | 301 |
| Da.2 | Positioning address P1 (movement amount for the incremental system) | Absolute system:<br>-2147483648 to 2147483647pulse<br>Incremental system:<br>0 to 2147483647pulse | 0pulse | | | 302<br>303 |
| Da.3 | Positioning speed V1 | 1 to 4000000pulse/s | 0pulse/s | | | 304<br>305 |
| Da.4 | Positioning address P2 (movement amount for the incremental system) | Absolute system:<br>-2147483648 to 2147483647pulse<br>Incremental system:<br>0 to 2147483647pulse | 0pulse | | | 306<br>307 |
| Da.5 | Positioning speed V2 | 1 to 4000000pulse/s | 0pulse/s | | | 308<br>309 |

# 9.6.2 Speed-position control switch mode

In the speed-position control switch mode, pulses that correspond to the specified positioning speed are output in the direction specified by a start signal. Then, once Speed-position switching command signal (CHANGE) is input, the operation switches to position control with the specified movement amount.
The speed-position control switch mode operates with the incremental system in which movement amount from a start address to an end address is specified.
Specify a forward start or a reverse start using one of the following signals.

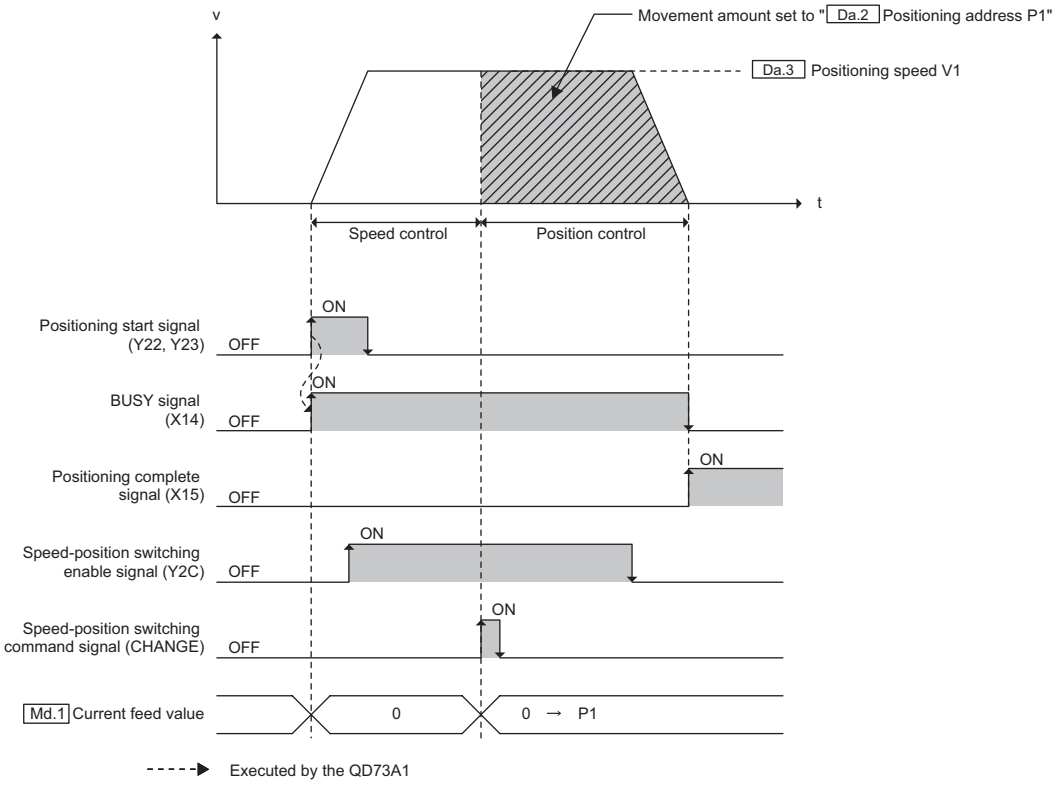
| Start signal | Positioning system |
|---|---|
| Forward start signal (Y22) | Forward start (address increasing) |
| Reverse start signal (Y23) | Reverse start (address decreasing) |

## (1) Switchover from speed control to position control

To switch the operation from speed control to position control, Speed-position switching enable signal (Y2C) must be turned on before inputting Speed-position switching command signal (CHANGE).
If Speed-position switching command signal (CHANGE) is input when Speed-position switching enable signal (Y2C) is off, the speed control continues without being switched to position control. The operation switches to position control when Speed-position switching command signal (CHANGE) is input after Speed-position switching enable signal (Y2C) was turned on.

## (2) Operation of the speed-position control switch mode

The operation is as follows.

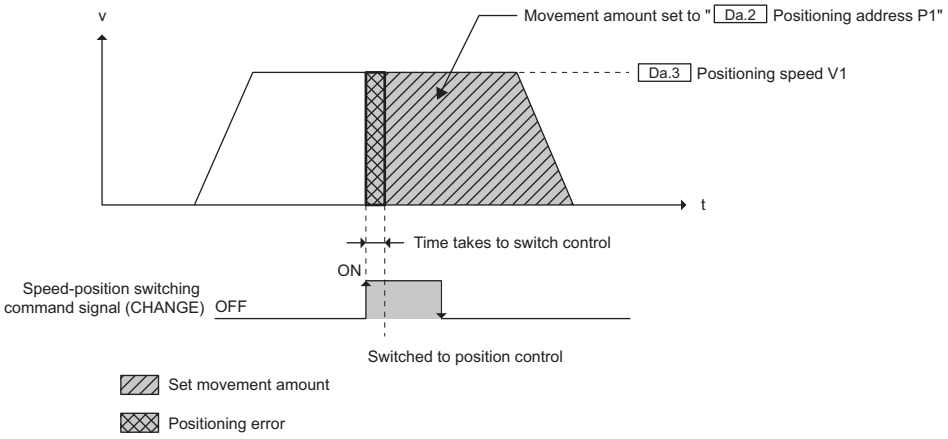


## (3) "Md.1 Current feed value" and "Md.2 Actual current value"

In "Md.1 Current feed value" and "Md.2 Actual current value", 0 is set at the start of the speed-position control switch mode, and the settings are not updated during speed control.
They are updated once the operation switched to position control by the input of Speed-position switching command signal (CHANGE).

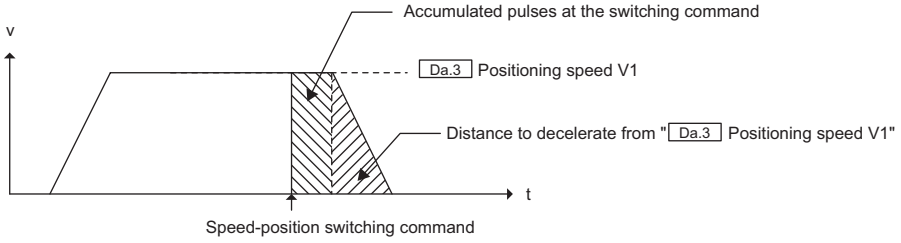
## (4) Positioning error in the speed-position control switch mode

In the speed-position control switch mode, operation switches to position control by an input of Speed-position switching command signal (CHANGE) during speed control. The process from the signal input to the completion of switchover to position control takes some time, resulting in a positioning error by pulses output during the process.
The process time varies by approximately 2ms including the response delay of Speed-position switching command signal (CHANGE).




## (5) "Da.2 Positioning address P1"

Set "Da.2 Positioning address P1" so that its setting value becomes greater than the value of the distance obtained using the following formula. If not, the positioning stops exceeding the specified movement amount.




$$\boxed{\text{Da.2}}\ \text{Positioning address P1} > (\text{Accumulated pulses at the switching command}) + (\text{Distance to decelerate from } \boxed{\text{Da.3}}\ \text{Positioning speed V1})$$

$$= \frac{\boxed{\text{Da.3}}\ \text{Positioning speed V1}}{\text{Position loop gain}} + \frac{1}{2} \times \text{Actual deceleration time} \times \boxed{\text{Da.3}}\ \text{Positioning speed V1}$$

## (6) Two-phase trapezoidal positioning control and speed-position control switchover

A speed-position control switchover cannot be performed in two-phase trapezoidal positioning control.

**Point**

Input Speed-position switching command signal (CHANGE) at the area where the speed is stable (constant speed status). When a servomotor is used, the actual movement amount after the switchover to position control is "Set movement amount + Accumulated pulse amount". If the signal is input during acceleration or deceleration, the operation stop position varies due to the variation in the accumulated pulse amount.

## (7) Parameter and positioning data setting

The following table lists the parameter and positioning data to be set, setting condition, and check timing. Set other parameters if necessary.

| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Pr.9 | Positioning mode | 0: Position control mode<br>1: Speed-position control switch mode | 0 | The data can be set anytime.<br>Note that the set data at the rise (ON) of a positioning start signal (Y22, Y23) are used for the operation. If the data are written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next positioning start signal (Y22, Y23). | When a positioning start signal (Y22, Y23) is turned on | 25 |
| Da.2 | Positioning address P1 (movement amount) | 0 to 2147483647pulse | 0pulse | | | 302<br>303 |
| Da.3 | Positioning speed V1 | 1 to 4000000pulse/s | 0pulse/s | | | 304<br>305 |

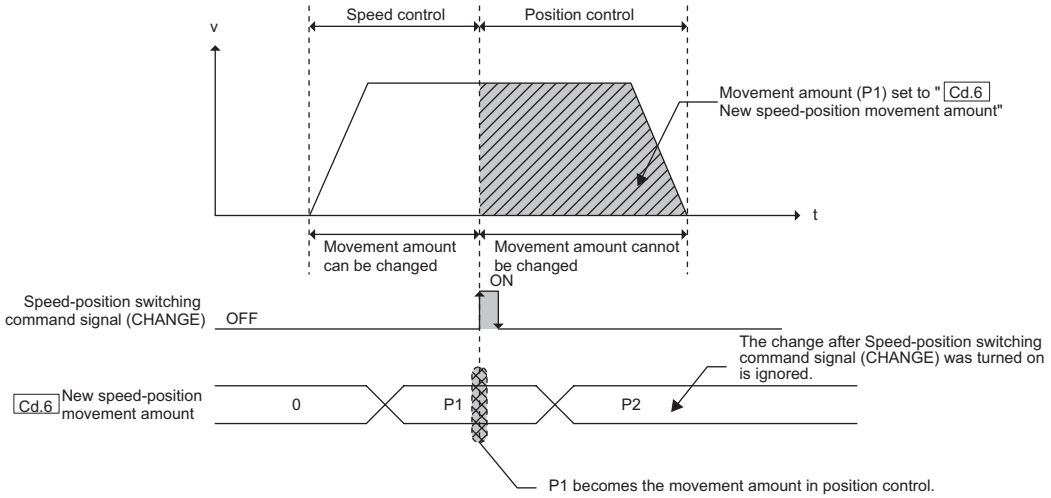
## (8) Speed-position movement amount change

The movement amount for position control can be changed during speed control of the speed-position control switch mode.

Set the new movement amount in "Cd.6 New speed-position movement amount" using a sequence program during speed control. The value in "Cd.6 New speed-position movement amount" is reflected as the movement amount for position control at the input of Speed-position switching command signal (CHANGE).

### (a) Operation of a speed-position movement amount change

The operation is as follows.




### (b) Cd.6 New speed-position movement amount

The setting is cleared to 0 when the next operation starts.

### (c) Data setting

The following table lists the data to be set, setting condition, and check timing.

| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Cd.6 | New speed-position movement amount | 1 to 2147483647pulse | 0pulse | The data can be set when BUSY signal (X14) is on during speed control, and besides before the input of Speed-position switching command signal (CHANGE). | At the input of Speed-position switching command signal (CHANGE) | 88<br>89 |

If " Cd.6 New speed-position movement amount" is a value that moves the workpiece outside the stroke limit range, the error "Movement outside the stroke limit range" (error code: 87) occurs at the input of Speed-position switching command signal (CHANGE), and the set new movement amount is ignored. (The value in " Da.2 Positioning address P1" (movement amount) is used.)

## (9) Operation of speed control

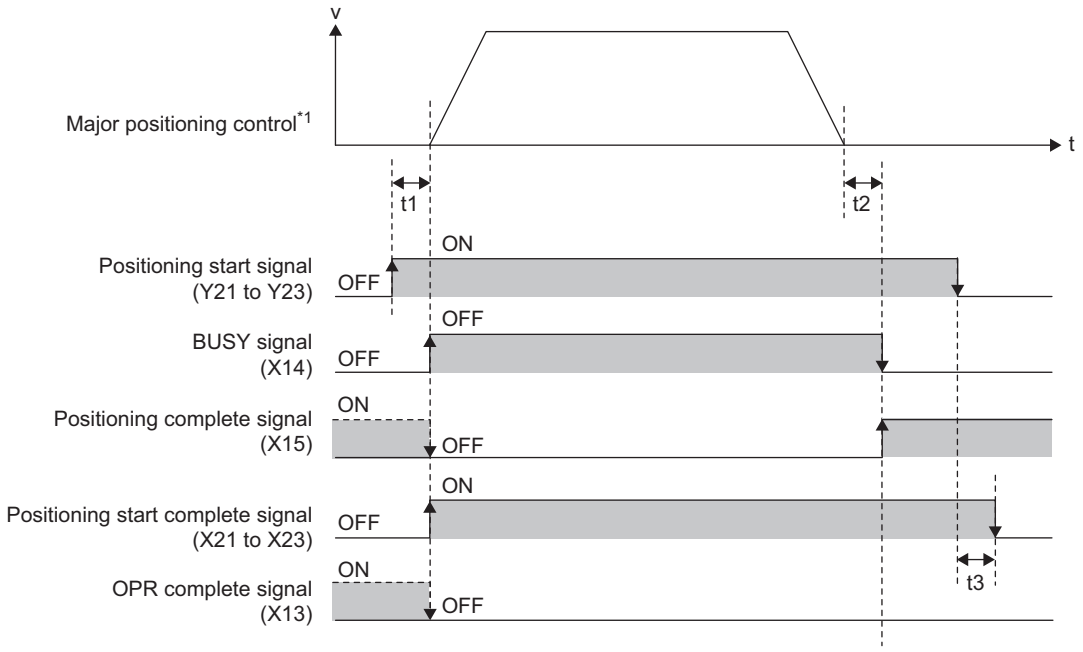
Operation can stay as speed control in the speed-position control switch mode when one of the following conditions is satisfied.

- Not to input Speed-position switching command signal (CHANGE)
- Not to turn on Speed-position switching enable signal (Y2C)

During speed control, the stroke limit function cannot be used since " Md.1 Current feed value" is not updated. A stroke range is from the lower limit switch (RLS) to the upper limit switch (FLS).

# 9.7 Operation Timing and Processing Time of Major Positioning Control

This section explains the operation timing and processing time of major positioning control.




*1 This is an indication of internal commands, and does not match with the actual analog output waveform.

The following values apply to t1 to t3.

| t1 | t2 | t3 |
|---|---|---|
| 0.7 to 1.2ms | 0 to 0.5ms | 0 to 0.5ms |

# CHAPTER 10 JOG OPERATION

The QD73A1's "JOG operation" can move the workpiece without using positioning data, but according to signal inputs and specified movement amount. Use this function for the following.

- To check the connection of a positioning system
- To obtain the address of positioning data
- To move the workpiece in the direction where a limit signal turns on if operation stopped when a limit signal turned off

"JOG operation" moves the workpiece in the specified direction at the specified speed while Forward JOG start signal (Y24) or Reverse JOG start signal (Y25) is on.

# 10.1 Operation of JOG Operation



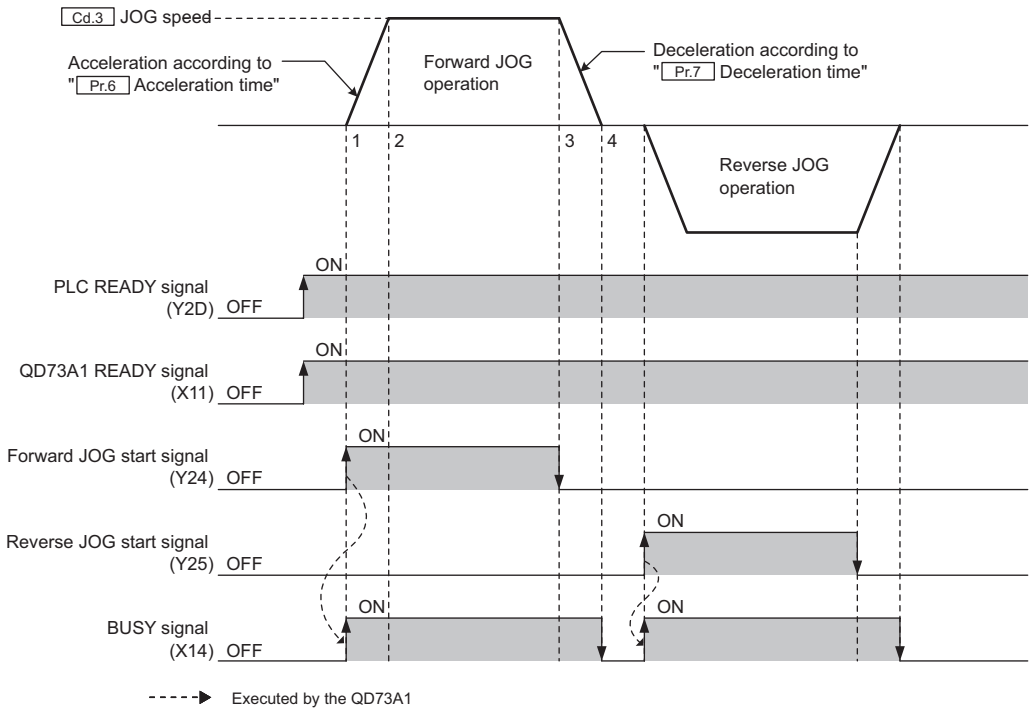
Once JOG speed is set and while a JOG start signal is turned on through a sequence program, the QD73A1 executes JOG operation in the specified direction by outputting analog voltage to the drive unit.
Choose forward run or reverse run using JOG start signals.

| Start signal | Operation direction |
|---|---|
| Forward JOG start signal (Y24) | Address increasing direction |
| Reverse JOG start signal (Y25) | Address decreasing direction |

## (1) Operation of JOG operation

The following is an example of JOG operation.

| | |
|---|---|
| 1 | As a JOG start signal is turned on, acceleration starts in the specified direction according to " Pr.6 Acceleration time". BUSY signal (X14) turns on at this time. |
| 2 | As the accelerating operation reaches the speed set in " Cd.3 JOG speed", the move continues maintaining the speed. The workpiece moves at the constant speed between 2 to 3 in the graph below. |
| 3 | As the JOG start signal is turned off, deceleration starts from the speed set in " Cd.3 JOG speed" according to " Pr.7 Deceleration time". |
| 4 | As the speed reaches 0, the operation stops. BUSY signal (X14) turns off at this time. |

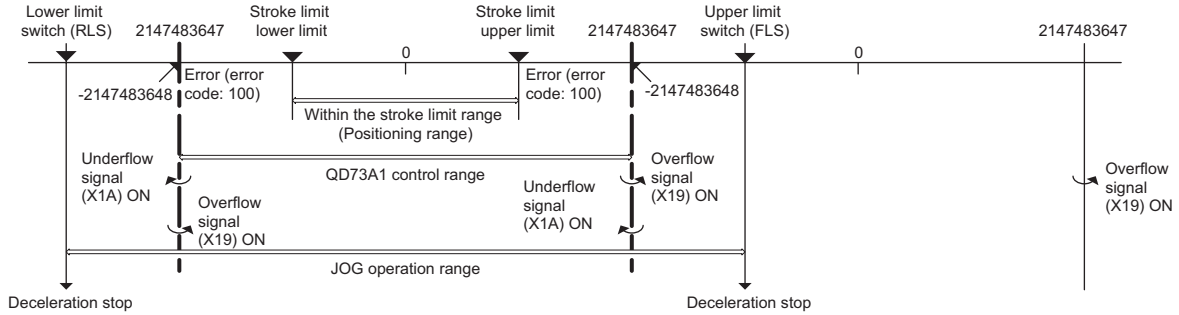



Speed can be changed by writing data to the control change area of the buffer memory using a sequence program.
For details, refer to the following.

☞Page 216, Section 11.6

## (2) Range of JOG operation

The following figure shows the range of JOG operation.



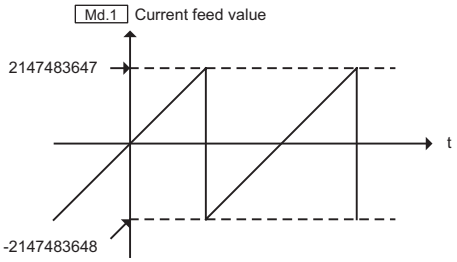

### (a) Range in which JOG operation can be executed

JOG operation can be executed within the range between the upper limit switch (FLS) and the lower limit switch (RLS). Note that the stroke limit upper limit and lower limit are ignored in JOG operation.

JOG operation decelerates and stops if Upper limit signal (FLS) or Lower limit signal (RLS) turned off during the operation.

### (b) When "Md.1 Current feed value" exceeded the QD73A1's control range during JOG operation

When the current feed value exceeded the QD73A1's control range (-2147483648 to 2147483647), Overflow signal (X19) or Underflow signal (X1A) turns on, and "Md.1 Current feed value" varies again as in the following figure.




Reset Overflow signal (X19) or Underflow signal (X1A) by turning on Overflow reset signal (Y29) or Underflow reset signal (Y2A).

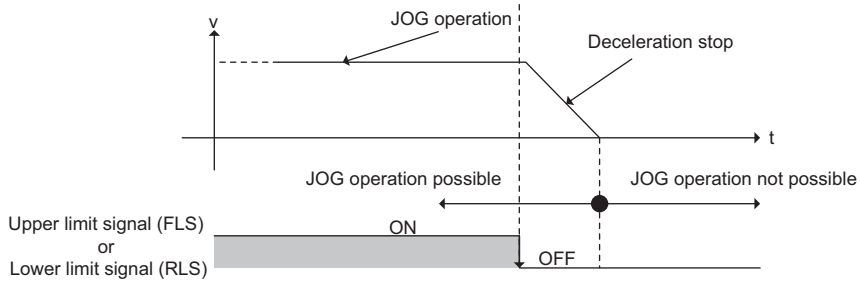
### (c) When the stroke limit range was exceeded during JOG operation

The error "Outside the stroke limit range" (error code: 100) occurs.

### (d) When the upper limit switch (FLS) or the lower limit switch (RLS) turned off

The error "Upper limit signal OFF while BUSY" (error code: 91) or the error "Lower limit signal OFF while BUSY" (error code: 92) occurs.

If operation decelerated and stopped due to the upper limit switch (FLS) or the lower limit switch (RLS), JOG operation can be executed in the opposite direction (direction back to the normal range) after resetting the error. (If the JOG start signal for the erroneous direction is turned on, the error occurs again.)

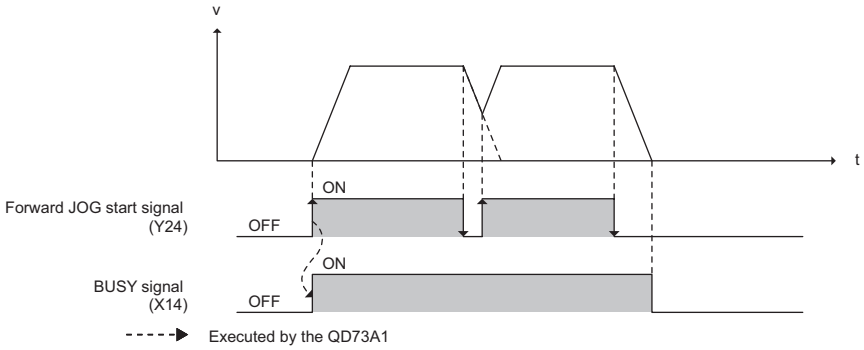



## (3) Precautions during operation

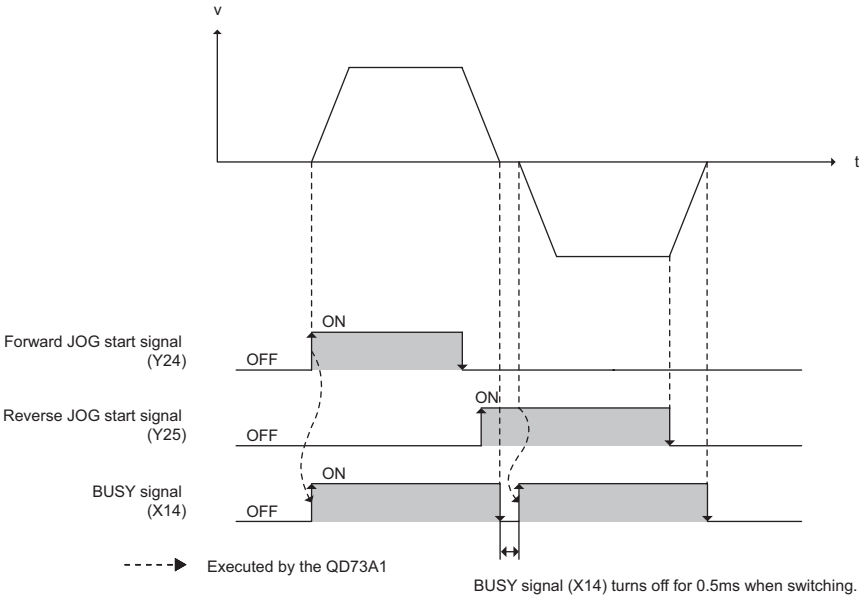
- Set a small value in "Cd.3 JOG speed" first to check the operation, then change it to greater values gradually for safe operation.
- If "Cd.3 JOG speed" is 0, the error "JOG speed Outside the setting range" (error code: 41) occurs, and the JOG operation does not start.
- If "Cd.3 JOG speed" exceeds "Pr.5 Speed limit value", the operation is executed at the speed set in "Pr.5 Speed limit value", but the error "JOG speed Outside the setting range" (error code: 41) occurs.

## (4) JOG start timing

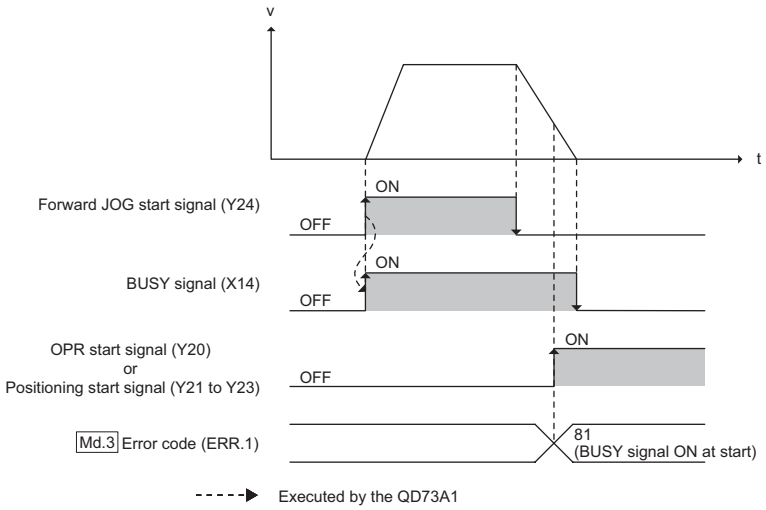
- During deceleration after a JOG start signal was turned off, if the JOG start signal for the same direction is turned on, JOG operation starts again accelerating its speed.




- During deceleration after a JOG start signal was turned off, if the JOG start signal for the opposite direction is turned on, JOG operation starts in the opposite direction after the completion of deceleration.



- During deceleration after a JOG start signal was turned off, if OPR start signal (Y20) or a positioning start signal (Y21 to Y23) is turned on, an error occurs and the operation does not start.




- If the JOG start signal for the opposite direction is turned on during JOG operation, the error "BUSY signal ON at start" (error code: 81) occurs and the operation in the opposite direction is not executed.
- If Forward JOG start signal (Y24) and Reverse JOG start signal (Y25) are turned on at the same time, the error "BUSY signal ON at start" (error code: 81) occurs and forward JOG operation is executed.

## (5) Sub functions for JOG operation

For details on "sub functions" that can be combined with JOG operation, refer to the following.

☞Page 30, Section 3.3 (4)

For details on each sub function, refer to the following.

☞Page 206, CHAPTER 11

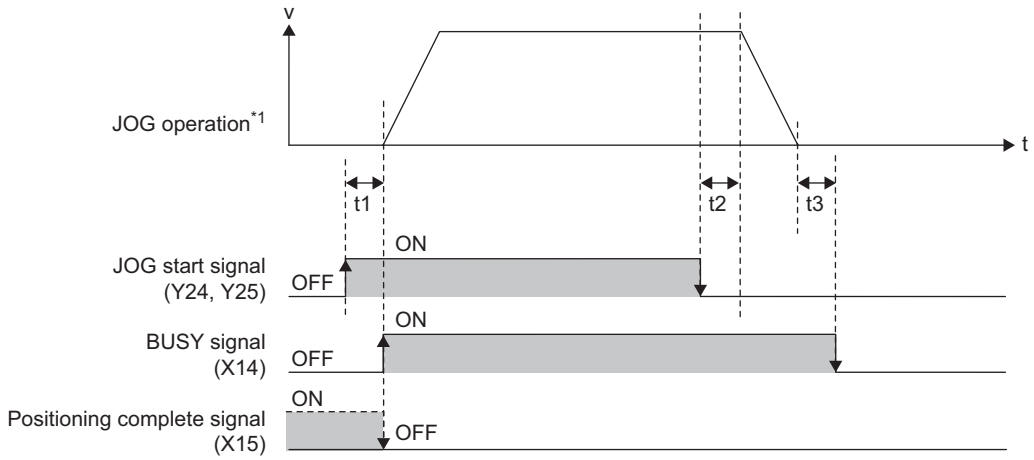
## (6) Monitoring JOG operation

To directly monitor the buffer memory using GX Works2, refer to the following.

☞Page 90, Section 5.6

# 10.2 Operation Timing and Processing Time of JOG Operation

This section explains the operation timing and processing time of JOG operation.




*1 This is an indication of internal commands, and does not match with the actual analog output waveform.

The following values apply to t1 to t3.

| t1 | t2 | t3 |
|---|---|---|
| 0.7 to 1.2ms | 0 to 0.5ms | 0 to 0.5ms |

# 10.3 Data Setting for JOG Operation



To execute JOG operation, certain data must be set and stored in the buffer memory areas.
The following table lists the JOG data to be set, setting condition, and check timing.

| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Cd.3 | JOG speed | 1 to 4000000pulse/s | 0pulse/s | The data can be set anytime. Note that the set data at the rise (ON) of a JOG start signal (Y24, Y25) are used for the operation. If the data are written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next JOG start signal (Y24, Y25). | When a JOG start signal (Y24, Y25) is turned on | 84<br>85 |
| Pr.5 | Speed limit value | 10 to 4000000pulse/s (Set in the unit of 10pulse/s.) | 200000 pulse/s | | | 20<br>21 |
| Pr.6 | Acceleration time | 2 to 9999ms | 300ms | | | 22 |
| Pr.7 | Deceleration time | | | | | 23 |

# CHAPTER 11 CONTROL SUB FUNCTIONS

Functions referred to as "sub function" compensate or limit control, or add functions at the execution of major positioning functions. Execute these sub functions by setting parameters or through a sequence program for them. The following functions are referred to as "sub function".

| Sub function | | Description | Reference |
|---|---|---|---|
| Functions to compensate control | Electronic gear function | This function controls moving distance and speed by multiplying command pulse output of the QD73A1. | Page 207, Section 11.1 |
| Functions to limit control | Speed limit function | This function limits command speed to the value set in " Pr.5 Speed limit value". | Page 209, Section 11.2 |
| | Stroke limit function | This function controls operation not to execute positioning when a command that moves the workpiece outside the specified stroke limit range is given. | Page 211, Section 11.3 |
| | Upper limit switch (FLS)/lower limit switch (RLS) function | This function decelerates and stops operation according to the detection on limit switches placed at the upper and lower stroke limits. | Page 213, Section 11.4 |
| Functions to change control details | Current value change function | This function changes the value set in " Md.1 Current feed value" to a specified value. | Page 215, Section 11.5 |
| | Speed change function | This function changes speed during major positioning control or JOG operation. | Page 216, Section 11.6 |
| | Deviation counter clear function | This function clears the accumulated pulses in the deviation counter. When the servomotor power was turned off due to an emergency stop during positioning, clearing the accumulated pulses in the deviation counter prevents servomotor rotation at power recovery. | Page 218, Section 11.7 |
| Other functions | In-position function | This function turns on In-position signal (X16) while the accumulated pulse amount in the deviation counter is within the specified in-position range (1 to 20479pulse). In-position signal (X16) can be used as the signal right before positioning completion. | Page 219, Section 11.8 |
| | Accumulated pulse error detection function | This function outputs an alert and immediately stops the positioning when the accumulated pulses reached the amount specified by the user before the pulses exceed the amount set in "Accumulated pulse setting" in the switch setting and an excessive error occurs. | Page 221, Section 11.9 |

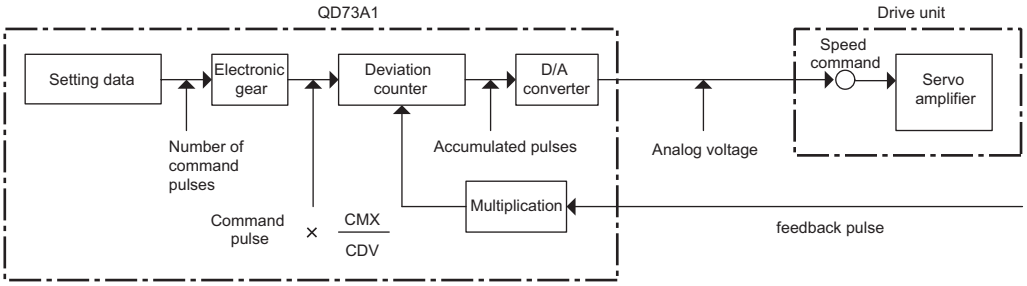
# 11.1 Electronic Gear Function

The "electronic gear function" controls machine movement amount per one command pulse by multiplying command pulse output of the QD73A1.
Positioning is much more flexible with the use of this function, eliminating the process of selecting a detector according to the machine system.



## (1) Details of the electronic gear function

Machine movement amount per one pulse is adjusted inside the QD73A1.
Electronic gear is active on all of OPR control, major positioning control, and JOG operation.




Set numerator and denominator of command pulse multiplication for electronic gear to parameters.
Satisfy the following condition when setting a numerator (CMX) and a denominator (CDV).

$$\frac{1}{50} \leqq \frac{CMX}{CDV} \leqq 50$$

If the setting range is exceeded, the error "Denominator of command pulse multiplication for electronic gear Outside the setting range" (error code: 3) occurs.
When the electronic gear function is used, positioning speed and movement amount are multiplied by the specified value.
When there are decimal pulses, the fractions are maintained inside and accumulated for the next command.
The following is an example of the use of electronic gear.

**Ex.** A positioning system using the following worm gear

- Worm gear lead: 10mm
- Feedback pulses from the servomotor: 12000pulse/rev

When the electronic gear function is not used, the feed rate (movement amount per pulse) has fractions.

$$\Delta \ell = \frac{10}{12000} = 0.000833 \cdots \text{mm/pulse}$$

In this system, the fractions can be avoided using the electronic gear function and setting numerator and denominator as follows: CMX/CDV = 12

$$\Delta \ell' = \frac{10}{12000} \times 12 = 0.01\text{mm/pulse}$$

## (2) Precautions for control

- Execute OPR without fail after resetting the CPU module. If not, a positioning error occurs by the fractions of electronic gear that were not output during positioning before the CPU reset.
- When the positioning speed value that was multiplied by the set value of electronic gear exceeds the speed limit value, the limit value is ignored. On the other hand, if the speed exceeds 4Mpulse/s, the maximum value of command frequency, the error "Outside the command frequency range" (error code: 104) occurs. In this case, the speed is 4Mpulse/s, resulting in a positioning error. To avoid this case, satisfy the following condition when setting positioning speed and electronic gear: Positioning speed × Electronic gear ≤ 4Mpulse/s

## (3) Setting the electronic gear function

The following table lists the data to be set, setting condition, and check timing.

| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Pr.3 | Numerator of command pulse multiplication for electronic gear (CMX) | 1 to 9999 | 1 | PLC READY signal (Y2D) must be off. | When PLC READY signal (Y2D) is turned on | 4 |
| Pr.4 | Denominator of command pulse multiplication for electronic gear (CDV) | | 1 | | | 5 |

# 11.2 Speed Limit Function

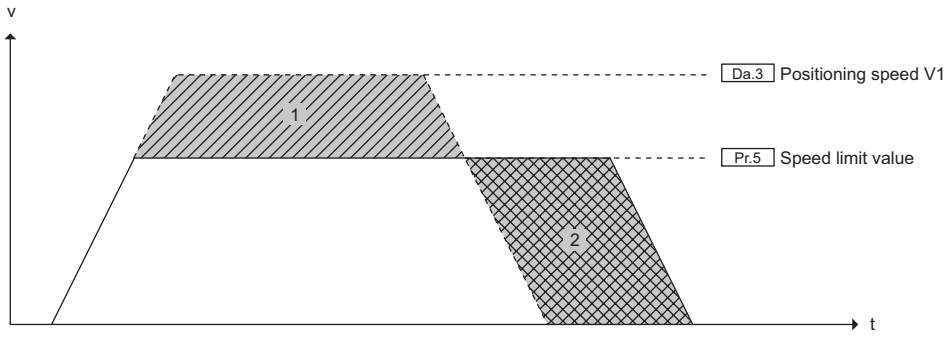
The "speed limit function" limits command speed to the value set in "Pr.5 Speed limit value" when command speed during major positioning control or JOG operation exceeds "Pr.5 Speed limit value".

## (1) Control detail

This function is active on major positioning control and JOG operation.

When the value set in "Pr.5 Speed limit value" is exceeded in each control, command speed is limited to "Pr.5 Speed limit value".

The operation of the speed limit function is as follows.




In the figure above, the speed set in "Pr.5 Speed limit value" is output since "Da.3 Positioning speed V1" is faster than "Pr.5 Speed limit value". In this case, the movement amount that was not output because of the speed limit (1 in the figure) is output later (2 in the figure), delaying the positioning completion.

## (2) Precautions for control

Set positioning speed and JOG speed to a value equal to or less than "Pr.5 Speed limit value". If "Pr.5 Speed limit value" is exceeded, command speed is limited to "Pr.5 Speed limit value".

Also, set OPR speed to a value equal to or less than "Pr.5 Speed limit value". If "Pr.5 Speed limit value" is exceeded, the error "OPR speed Outside the setting range" (error code: 20) occurs at the start of OPR.

### (3) Setting the speed limit function

The following table lists the data to be set, setting condition, and check timing.

| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Pr.5 | Speed limit value | 10 to 4000000pulse/s (Set in the unit of 10pulse/s.) | 200000 pulse/s | The data can be set anytime.<br>Note that the set data at the rise (ON) of a start signal is used for the operation. If the data is written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next start signal. | • When a positioning start signal (Y21 to Y23) is turned on<br>• When a JOG start signal (Y24, Y25) is turned on<br>• When OPR start signal (Y20) is turned on | 20<br>21 |

**Point**

Set " Pr.5 Speed limit value" in a unit of 10 pulses. If a single digit is set, the value is rounded off.

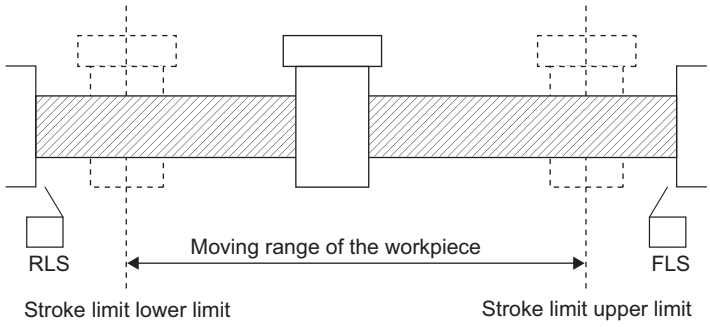
**Ex.** For instance, if "1999" is set, the operation is executed with a speed limit value of "1990".

# 11.3 Stroke Limit Function

The "stroke limit function" controls operation not to execute positioning when a command that moves the workpiece outside the specified stroke limit range is given.

## (1) Control detail

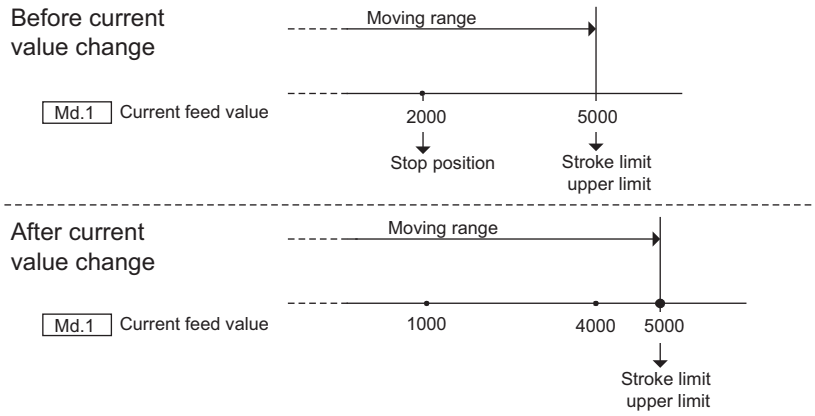
This function limits the moving range of the workpiece.
The following figure shows a moving range of a workpiece when the stroke limit function is used.




The following is an example in which a moving range of a workpiece changes following a current value change.

**Ex.** When the current stop position is 2000 and the stroke limit upper limit is set to 5000

As the current value is changed from 2000 to 1000, "Md.1 Current feed value" changes to 1000, expanding the moving range of the workpiece.



## (2) Stroke limit check details and processing for each control

The following table describes stroke limit checks and processing in case of an error that are performed by the QD73A1.

| Check number | Check detail | Processing in case of an error |
|---|---|---|
| 1 | If a current value is outside the stroke limit range[*1], the module reports an error. (The module checks " Md.1 Current feed value".) | The module turns on Error detection signal (X18), and reports the error "Outside the stroke limit range at start" (error code: 83). |
| 2 | If a positioning address setting is outside the stroke limit range[*1], the module reports an error. (The module checks " Da.2 Positioning address P1".) | The module turns on Error detection signal (X18), and reports the error "Positioning address Outside the setting range" (error code: 30). |
| 3 | If a current value exceeds the stroke limit range[*1], the module reports an error. (The module checks " Md.1 Current feed value".) | The module turns on Error detection signal (X18), and reports the error "Outside the stroke limit range" (error code: 100). |

*1 The range from " Pr.1 Stroke limit upper limit" to " Pr.2 Stroke limit lower limit"

The following table describes the corresponding stroke limit check for each control.

| Control | | | Stroke limit check |
|---|---|---|---|
| OPR control | | | Stroke limit check 3 is performed. |
| Major positioning control | Position control mode | Positioning control | Stroke limit check 1 and 2 are performed. |
| | | Two-phase trapezoidal positioning control | |
| | Speed-position control switch mode | | |
| JOG operation | | | Stroke limit check 3 is performed. |
| Current value change | | | No stroke limit check is performed. |

## (3) Precaution for control

To execute the stroke limit function normally, OPR must be executed beforehand.

## (4) Setting the stroke limit function

The following table lists the data to be set, setting condition, and check timing.

| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Pr.1 | Stroke limit upper limit | -2147483648 to 2147483647 pulse | 2147483647 pulse | PLC READY signal (Y2D) must be off. | When PLC READY signal (Y2D) is turned on | 0<br>1 |
| Pr.2 | Stroke limit lower limit | | 0pulse | | | 2<br>3 |

## (5) Disabling the stroke limit function

Set values as follows.

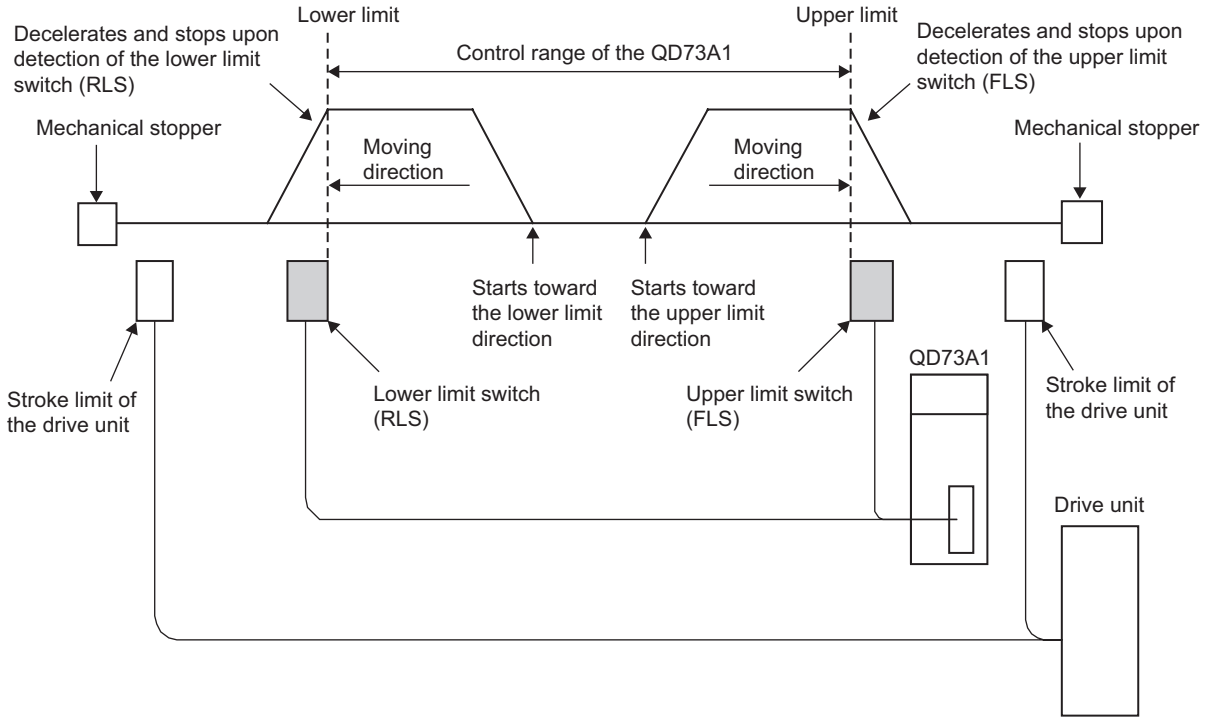
Pr.1 Stroke limit upper limit = Pr.2 Stroke limit lower limit

# 11.4 Upper Limit Switch (FLS)/Lower Limit Switch (RLS) Function

The "upper limit switch (FLS)/lower limit switch (RLS) function" decelerates and stops operation according to signal inputs from limit switches that are placed at the upper and lower limits of the machine's movable range.
This function prevents the machine from being damaged by stopping the operation before the workpiece reaches the upper or lower limit of the moving range, which is a physical limit that the QD73A1 can handle.
Normally, upper limit switch (FLS) and lower limit switch (RLS) are placed inside the stroke limits (stroke ends) of the drive unit, so that the operation is stopped before the workpiece reaches a stroke limit (stroke end) of the drive unit.

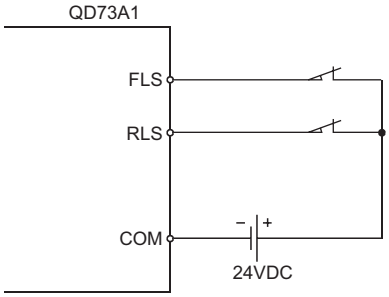
## (1) Control detail

The following figure shows the operation of the upper limit switch (FLS)/lower limit switch (RLS) function.


Lower limit
Upper limit
Decelerates and stops upon detection of the lower limit switch (RLS)
Control range of the QD73A1
Decelerates and stops upon detection of the upper limit switch (FLS)
Mechanical stopper
Moving direction
Moving direction
Mechanical stopper
Starts toward the lower limit direction
Starts toward the upper limit direction
QD73A1
Stroke limit of the drive unit
Lower limit switch (RLS)
Upper limit switch (FLS)
Stroke limit of the drive unit
Drive unit

## (2) Wiring upper limit switch (FLS) and lower limit switch (RLS)

To use the upper limit switch (FLS)/lower limit switch (RLS) function, wire the QD73A1's terminals for Upper limit signal (FLS) and Lower limit signal (RLS) as in the following figure.



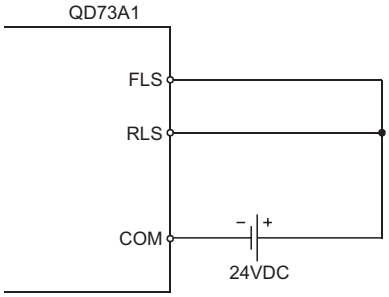

When wiring the terminals, set the switch that is placed on the direction in which "Md.1 Current feed value" increases as an upper limit switch (FLS), and the switch that is placed on the direction in which "Md.1 Current feed value" decreases as a lower limit switch (RLS).
If the upper and lower limit switches are wired opposite, the upper limit switch (FLS)/lower limit switch (RLS) function does not operate normally, and the motor does not stop.

## (3) Precautions for control

- OPR control, major positioning control, and JOG operation cannot be started from the area where the upper limit switch (FLS) had detected overrange in the direction where "Md.1 Current feed value" increases. Also, OPR control, major positioning control, and JOG operation cannot be started from the area where the lower limit switch (RLS) had detected overrange in the direction where "Md.1 Current feed value" decreases. To start operation again, move the workpiece to a position within the control range of the QD73A1 using JOG operation.
- If the wiring between Upper limit signal (FLS) and COM terminal or between Lower limit signal (RLS) and COM terminal is open (including the case that the terminals are not wired), the QD73A1 cannot execute positioning.

## (4) When the upper limit switch (FLS)/lower limit switch (RLS) function is not used

Wire the QD73A1's terminals for Upper limit signal (FLS) and Lower limit signal (RLS) as in the following figure.



# 11.5 Current Value Change Function

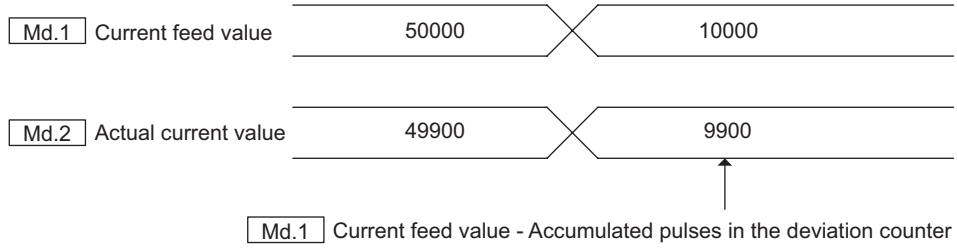
The "current value change function" changes the value set in "Md.1 Current feed value" to a specified value.
Use this function when operation cannot be started due to a current feed value outside the stroke range, or to change the current value.



## (1) Control detail

As a new address is set in "Cd.1 New current value" and "1" is written in "Cd.7 Current value change request", "Md.1 Current feed value" changes to the value set in "Cd.1 New current value".

"Md.2 Actual current value" is equal to "Md.1 Current feed value - Accumulated pulses in the deviation counter". When the accumulated pulse amount in the deviation counter is 0, "Md.1 Current feed value" is equal to "Md.2 Actual current value".




## (2) Precautions for control

- If "1" is set in "Cd.7 Current value change request" when BUSY signal (X14) is on, the error "Current value change error" (error code: 110) occurs and the current value is not changed.
- If the current value is changed to a value outside the stroke limit range, an error does not occur.

## (3) Data setting and the execution condition of the function

The following table lists the data to be set and the condition to execute the current value change function.

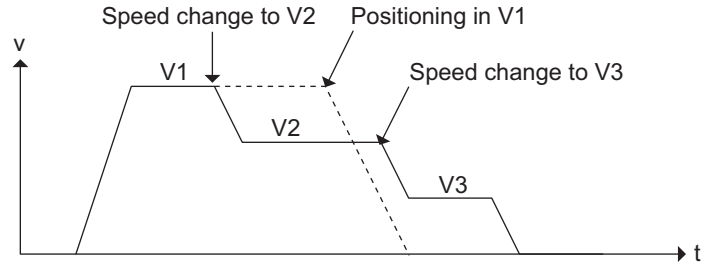
| Setting item | | Setting range | Default value | Execution condition of the current value change function | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.1 | New current value | -2147483648 to 2147483647pulse | 0pulse | BUSY signal (X14) must be off. | 80<br>81 |
| Cd.7 | Current value change request | 1: Change the current value | 0 | | 90 |

# 11.6 Speed Change Function

The "speed change function" changes the speed of the operation in process to a specified speed at a specified timing. Set a new speed value to the buffer memory and request the speed change.

## (1) Control detail

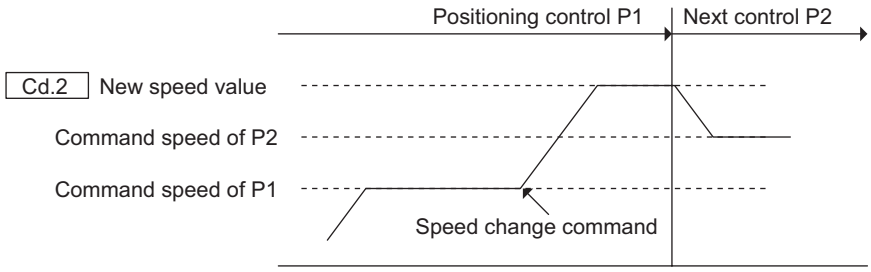
The following figure shows the operation of speed changes.




## (2) Precautions for control

### (a) Speed change during two-phase trapezoidal positioning control

- A speed change requested during two-phase trapezoidal positioning control is reflected to the command speed ( Da.3 , Da.5 ) of the next positioning data.




- If the remaining distance is not enough to change speed, the speed cannot be changed during two-phase trapezoidal positioning control.

### (b) Timing at which speed cannot be changed

Speed cannot be changed at the following timings.

- During deceleration following a stop command
- During OPR
  (The error "Speed change error (OPR)" (error code: 111) occurs.)
- During automatic deceleration in major positioning control
  (The error "Speed change error (Positioning)" (error code: 112) occurs.)
- During deceleration stop of JOG operation following a change (from on to off) of a JOG start signal (Y24, Y25)
  (The error "Speed change error (JOG)" (error code: 113) occurs.)

### (c) New speed and "Pr.5 Speed limit value"

When the value set in "Cd.2 New speed value" exceeds "Pr.5 Speed limit value", the positioning is operated at "Pr.5 Speed limit value".

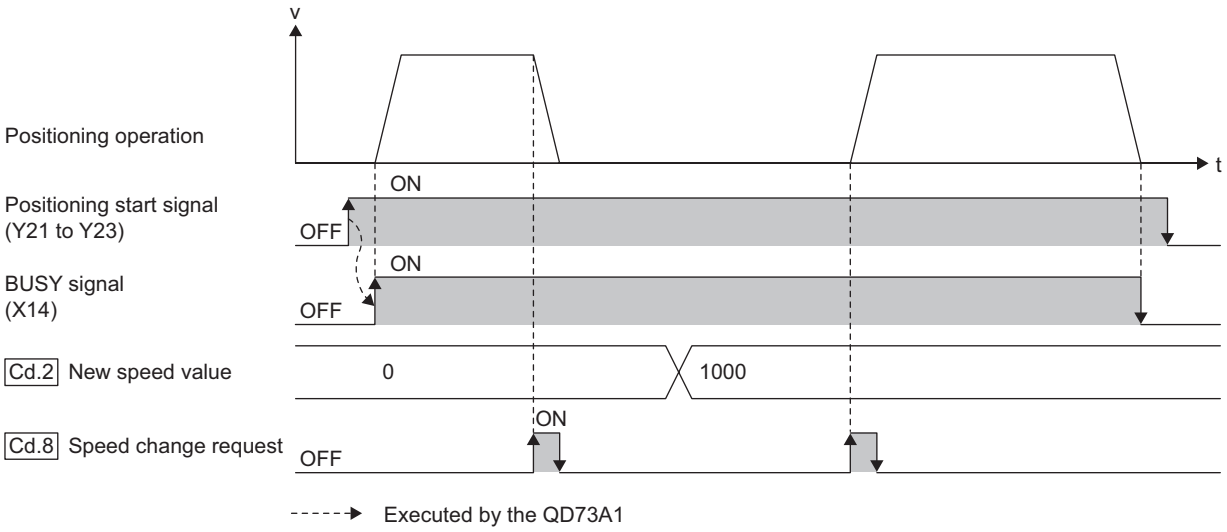
### (d) Successive speed changes

To change speed successively, set an interval of 10ms or more between each speed change. If there are not enough intervals between speed changes, the QD73A1 may not be able to follow the requests and process the commands normally.

### (e) When "0" is set in "Cd.2 New speed value"

When "0" is set in "Cd.2 New speed value" and a speed change is requested, the axis stops. Though, BUSY signal (X14) stays on. (Inputting Stop signal turns off BUSY signal (X14).)

To activate the axis again, set a value other than "0" in "Cd.2 New speed value" and request the speed change.




## (3) Data setting and the execution condition of the function

The following table lists the data to be set and the condition to execute the speed change function.

| Setting item | | Setting range | Default value | Execution condition of the speed change function | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.2 | New speed value | 0 to "Pr.5 Speed limit value" (pulse/s) (Maximum 4000000 pulse/s) | 0pulse/s | BUSY signal (X14) must be on. Note that speed cannot be changed at the following.<br>• After the start of automatic deceleration<br>• After the input of Stop signal (Y27) or Stop signal (STOP)<br>• After a JOG start signal (Y24, Y25) was turned off during JOG operation<br>• During OPR | 82<br>83 |
| Cd.8 | Speed change request | 1: Change speed | 0 | | 91 |

# 11.7 Deviation Counter Clear Function

The "deviation counter clear function" clears the accumulated pulses in the deviation counter to 0.
When the servomotor power was turned off due to an emergency stop during positioning, clearing the accumulated pulses in the deviation counter to 0 prevents servomotor rotation at power recovery.

## (1) Precautions for control

### (a) Start after clearing deviation counter

To start positioning after clearing the deviation counter, check the following two points.

- The value in "Cd.4 Deviation counter clear command" changed to 0.
- No error is occurring.

### (b) "Md.2 Actual current value" and "Md.1 Current feed value"

- When the deviation counter is cleared, "Md.2 Actual current value" changes to the value in "Md.1 Current feed value".
- To change "Md.1 Current feed value" of after clearing the deviation counter to "Md.2 Actual current value" of before clearing the deviation counter, follow the procedure below.

| | |
|---|---|
| 1 | Read out the value in "Md.2 Actual current value". |
| 2 | Write the read value to "Cd.1 New current value". |
| 3 | Clear the deviation counter. |
| 4 | Change the current value. |

## (2) Data setting and the execution condition of the function

The following table lists the data to be set and the condition to execute the deviation counter clear function.

| Setting item | | Setting range | Default value | Execution condition of the deviation counter clear function | Buffer memory address (decimal) |
|---|---|---|---|---|---|
| Cd.4 | Deviation counter clear command | 1: Clear the deviation counter | 0 | BUSY signal (X14) must be off. | 86 |

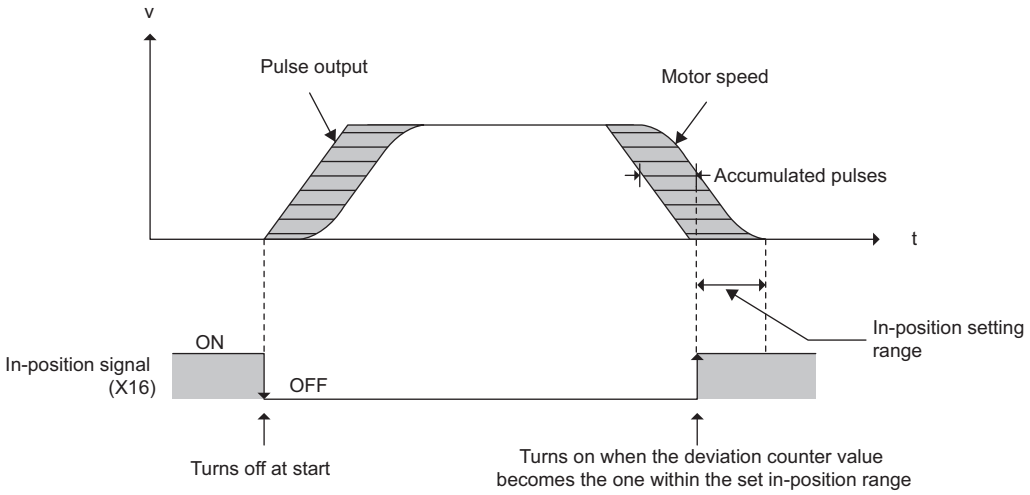
# 11.8 In-position Function

The "in-position function" turns on In-position signal (X16) while the accumulated pulse amount in the deviation counter is within the specified in-position range (1 to 20479pulse) after deceleration started.
In-position signal (X16) can be used as the signal right before positioning completion.



## (1) Control detail

In-position signal (X16) turns on when the accumulated pulse amount in the deviation counter becomes equal to the value set in "Pr.8 In-position range" and stays on till the next start.




Accumulated pulse amount is checked with the in-position range every 0.5ms.

## (2) Precautions for control

### (a) During speed control in the speed-position control switch mode

Accumulated pulse amount is not checked with the in-position range.

### (b) Timing at which In-position signal (X16) turns off

In-position signal (X16) turns off at the following timings.

- When OPR starts
- When positioning control starts
- When two-phase trapezoidal positioning control starts
- When the speed-position control switch mode starts
- When JOG operation starts

### (3) Setting the in-position function

The following table lists the data to be set, setting condition, and check timing.

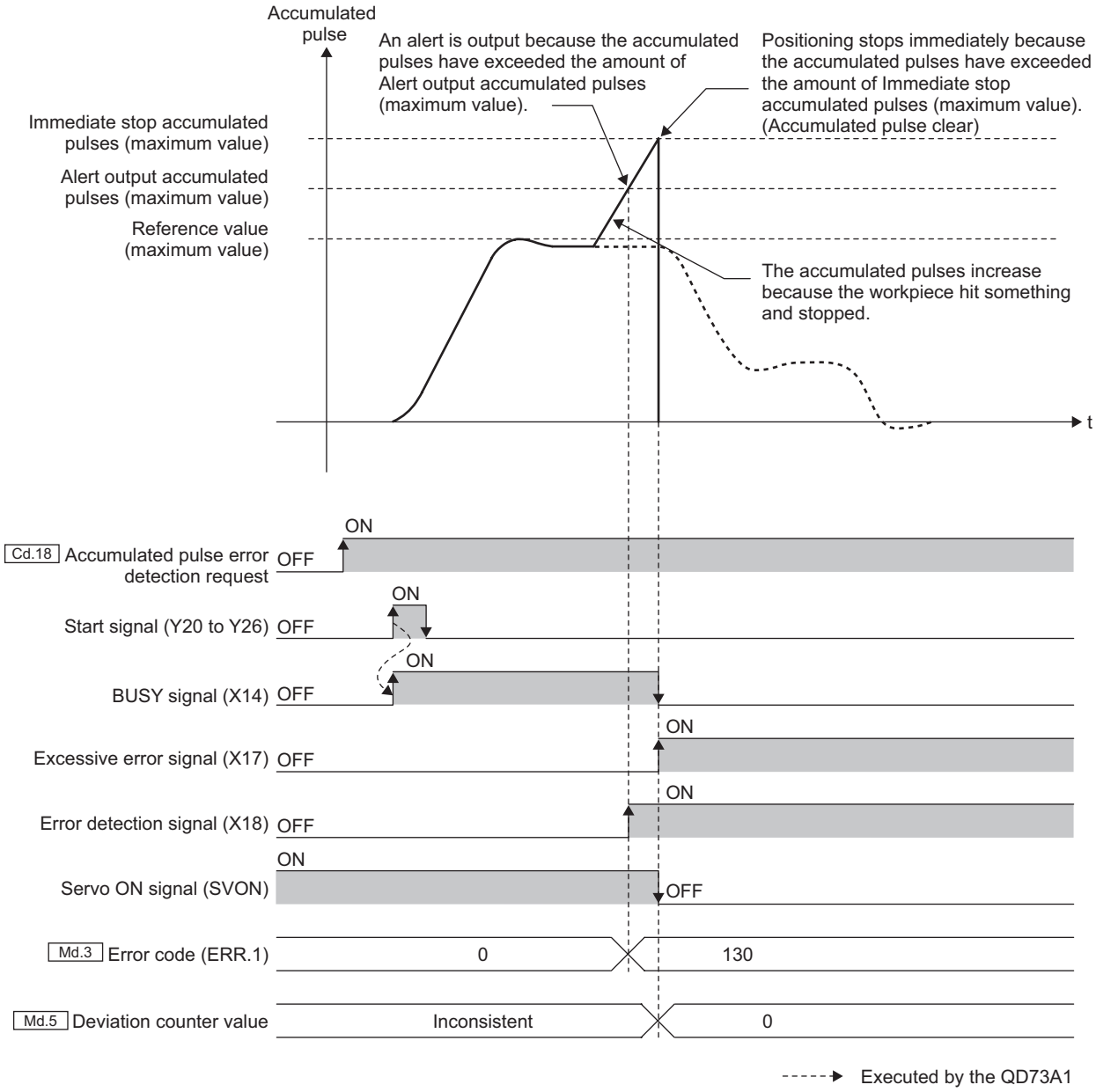
| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Pr.8 | In-position range | 1 to 20479pulse | 5pulse | The data can be set anytime. Note that the set data at the rise (ON) of a start signal is used for the operation. If the data is written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next start signal. | • When a positioning start signal (Y21 to Y23) is turned on<br>• When a JOG start signal (Y24, Y25) is turned on<br>• When OPR start signal (Y20) is turned on | 24 |

# 11.9 Accumulated Pulse Error Detection Function

The accumulated pulse error detection function outputs an alert and immediately stops the positioning when the accumulated pulses reached the amount specified by the user before the pulses exceed the amount set in "Accumulated pulse setting" in the switch setting and an excessive error occurs.
This function enables to detect abnormal operating status in early stages and minimize the influence on the mechanical system.

## (1) Control details

The following figures show the operation of the accumulated pulse error detection function.


Accumulated pulse
An alert is output because the accumulated pulses have exceeded the amount of Alert output accumulated pulses (maximum value).
Positioning stops immediately because the accumulated pulses have exceeded the amount of Immediate stop accumulated pulses (maximum value). (Accumulated pulse clear)
Immediate stop accumulated pulses (maximum value)
Alert output accumulated pulses (maximum value)
Reference value (maximum value)
The accumulated pulses increase because the workpiece hit something and stopped.
t
Cd.18 Accumulated pulse error detection request
Start signal (Y20 to Y26)
BUSY signal (X14)
Excessive error signal (X17)
Error detection signal (X18)
Servo ON signal (SVON)
Md.3 Error code (ERR.1)
Md.5 Deviation counter value
ON
OFF
0
130
Inconsistent
0
Executed by the QD73A1

### (a) Alert output

The QD73A1 compares accumulated pulses that are output during the positioning with alert output accumulated pulses. If accumulated pulses exceed the amount of the alert output accumulated pulses, the error "Accumulated pulse alert" (error code: 130) occurs. (Even after the error occurs, the positioning continues.)

### (b) Immediate stop processing

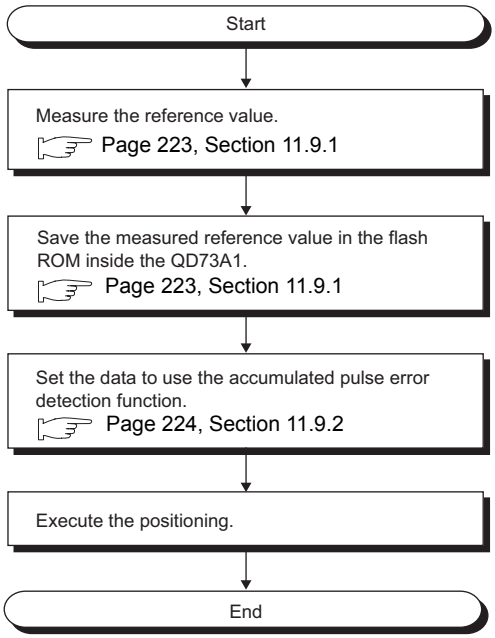
The QD73A1 compares accumulated pulses that are output during the positioning with immediate stop accumulated pulses. If accumulated pulses exceed the amount of the immediate stop accumulated pulses, the QD73A1 performs the following processing and stops the positioning.

- Excessive error signal (X17): ON
- Accumulated pulse: Clear to 0
- Servo ON signal (SVON): OFF
- BUSY signal (X14): OFF (Positioning complete signal (X15) does not turn on.)

Turn on PLC READY signal (Y2D) to restore the positioning (In the same way as when an excessive error occurs).

## (2) Executing procedure

The following is the executing procedure of the accumulated pulse error detection function.


Start
Measure the reference value.
Page 223, Section 11.9.1
Save the measured reference value in the flash ROM inside the QD73A1.
Page 223, Section 11.9.1
Set the data to use the accumulated pulse error detection function.
Page 224, Section 11.9.2
Execute the positioning.
End

# 11.9.1 Measuring and saving the reference value in the flash ROM

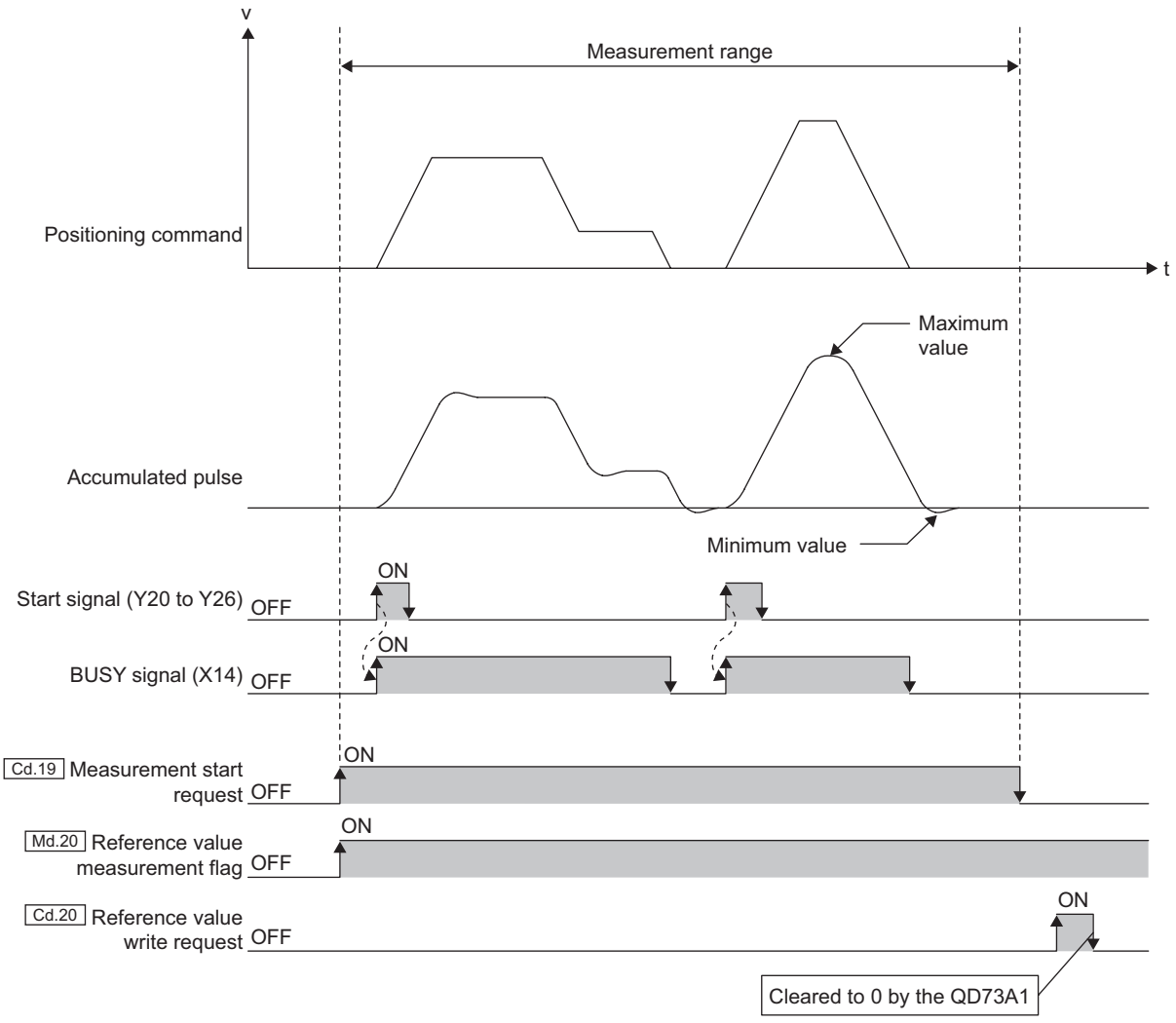
Before using the accumulated pulse error detection function, the reference value needs to be measured to detect errors.

Reference value means the maximum/minimum accumulated pulse values that are output when the QD73A1 is operating normally.

The QD73A1 obtains the judgment value for alert output and immediate stop and carry out control using the reference value, alert output accumulated pulse setting value, and immediate stop accumulated pulse setting value.

Executing procedure is as follows.

1. **Set "Cd.19 Measurement start request" to "1: Requested" and start the reference value measurement.**
   The QD73A1 monitors the status of accumulated pulses and measures the maximum/minimum values while "Cd.19 Measurement start request" is set to 1.
2. **Set "Cd.20 Reference value write request" to "1: Requested" when "Md.20 Reference value measurement flag" is set to "1: Measured".**
   The QD73A1 saves the measured maximum/minimum values in the flash ROM when "Cd.20 Reference value write request" is set to 1.



# 11.9.2 Setting the accumulated pulse error detection function

Set the values of "Cd.13 Alert output accumulated pulse setting value (maximum value)" to "Cd.16 Immediate stop accumulated pulse setting value (minimum value)", and set "Cd.18 Accumulated pulse error detection request" to 1 to execute the accumulated pulse error detection function. Set the data required for control in the sequence program. The following table lists the data to be set, setting condition, and check timing.

| Setting item | | Setting range | Default value | Setting condition | Check timing of the set data | Buffer memory address (decimal) |
|---|---|---|---|---|---|---|
| Cd.13 | Alert output accumulated pulse setting value (maximum value)*1*2 | • If "Cd.17 Accumulated pulse setting value selection" is set to 0: 1 to 148000 pulse<br>• If "Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000 (× $10^{-3}$) | 0 | The data can be set anytime. | When accumulated pulse error detection is requested (When "Cd.18 Accumulated pulse error detection request" is changed from 0 to 1.) | 400<br>401 |
| Cd.14 | Immediate stop accumulated pulse setting value (maximum value)*1*2 | | 0 | | | 402<br>403 |
| Cd.15 | Alert output accumulated pulse setting value (minimum value)*1*2 | • If "Cd.17 Accumulated pulse setting value selection" is set to 0: -148000 to -1 pulse<br>• If "Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000 (× $10^{-3}$) | 0 | | | 404<br>405 |
| Cd.16 | Immediate stop accumulated pulse setting value (minimum value)*1*2 | | 0 | | | 406<br>407 |
| Cd.17 | Accumulated pulse setting value selection | 0: Set with pulse<br>1: Set with magnification | 0: Set with pulse | | | 408 |
| Cd.18 | Accumulated pulse error detection request*3 | 0: No request<br>1: Requested | 0: No request | "Cd.19 Measurement start request" must be set to 0. | — | 409 |
| Cd.19 | Measurement start request*3 | 0: No request<br>1: Requested | 0: No request | "Cd.18 Accumulated pulse error detection request" must be set to 0. | — | 410 |
| Cd.20 | Reference value write request*3 | 0: No request<br>1: Requested | 0: No request | "Md.20 Reference value measurement flag" must be set to 1. | — | 411 |

*1 Set both alert output accumulated pulse setting value and immediate stop accumulated pulse setting value. If either of the values is set to 0, the accumulated pulse error detection function does not operate. The error "Accumulated pulse error undetectable" (error code: 131) occurs.

*2 If either of the maximum value and minimum value is set properly, the accumulated pulse error detection function operates. The error detection is not executed for the unset side.

*3 Each request is detected on a cycle of 0.5ms.

## (1) Alert output accumulated pulses and immediate stop accumulated pulses

Alert output accumulated pulses (accumulated pulses set to output an alert) and immediate stop accumulated pulses (accumulated pulses set to stop the positioning immediately) are set by combining the following values.

- Reference value
- Alert output accumulated pulse setting value ( Cd.13 , Cd.15 )
- Immediate stop accumulated pulse setting value ( Cd.14 , Cd.16 )
- Cd.17 Accumulated pulse setting value selection

## (2) If " Cd.17 Accumulated pulse setting value selection" is set to "0: Set with pulse"

Alert output accumulated pulses and immediate stop accumulated pulses can be obtained as follows:

Alert output accumulated pulses = reference value + alert output accumulated pulse setting value
Immediate stop accumulated pulses = reference value + immediate stop accumulated pulse setting value

### (a) When the value is outside the setting range

The accumulated pulse error detection function does not operate.

### (b) Alert output accumulated pulse setting value and immediate stop accumulated pulse setting value

The value of alert output accumulated pulses (maximum value) is calculated using the value of

" Cd.14 Immediate stop accumulated pulse setting value (maximum value)" at the following condition:

" Cd.13 Alert output accumulated pulse setting value (maximum value)" > " Cd.14 Immediate stop accumulated pulse setting value (maximum value)"

The value of alert output accumulated pulses (minimum value) is calculated using the value of

" Cd.16 Immediate stop accumulated pulse setting value (minimum value)" at the following condition:

" Cd.15 Alert output accumulated pulse setting value (minimum value)" < " Cd.16 Immediate stop accumulated pulse setting value (minimum value)"

Ex. When the setting values are as follows:

- Cd.13 Alert output accumulated pulse setting value (maximum value): 1200
- Cd.14 Immediate stop accumulated pulse setting value (maximum value): 1100

  Both alert output accumulated pulses and immediate stop accumulated pulses are judged by the reference value + 1100 pulse. Thus, an alert is output and the positioning stops simultaneously.

### (c) Alert output accumulated pulse setting value, immediate stop accumulated pulse setting value, and "Accumulated pulse setting" in the switch setting

The setting range of "Cd.13 Alert output accumulated pulse setting value (maximum value)" is 1 to 148000 (the range of "Cd.15 Alert output accumulated pulse setting value (minimum value)" is -148000 to -1). However, when the alert output accumulated pulses exceed the amount of "Accumulated pulse setting" in the switch setting, an alert is output according to the setting of "Accumulated pulse setting".

The above is applicable to "Cd.14 Immediate stop accumulated pulse setting value (maximum value)" and "Cd.16 Immediate stop accumulated pulse setting value (minimum value)".

**Ex.** When the measured reference value (maximum value) is 2000 and the setting values are as follows:

- "Accumulated pulse setting" in the switch setting: -3700 to 3700 [selection 1]
- Cd.13 Alert output accumulated pulse setting value (maximum value): 3000

The calculated value of alert output accumulated pulses (maximum value) is 5000 (2000 + 3000). However, the value of alert output accumulated pulses (maximum value) becomes 3700 because the calculated value exceeds the amount of "Accumulated pulse setting"

## (3) If "Cd.17 Accumulated pulse setting value selection" is set to "1: Set with magnification"

Alert output accumulated pulses and immediate stop accumulated pulses can be obtained as follows:

Alert output accumulated pulses = reference value + (Alert output accumulated pulse setting value - 1000) × reference value ÷ 1000
Immediate stop accumulated pulses = reference value + (immediate stop accumulated pulse setting value - 1000) × reference value ÷ 1000

Last three digits of the setting value indicate the value after the decimal point.

**Ex.** When the alert output accumulated pulse setting value is 1234, the alert output accumulated pulses can be obtained by multiplying the reference value by 1.234.

### (a) When the value is outside the setting range

The accumulated pulse error detection function does not operate.

### (b) Alert output accumulated pulse setting value and immediate stop accumulated pulse setting value

The value of alert output accumulated pulses (maximum value) is calculated using the value of "Cd.14 Immediate stop accumulated pulse setting value (maximum value)" at the following condition:

"Cd.13 Alert output accumulated pulse setting value (maximum value)" > "Cd.14 Immediate stop accumulated pulse setting value (maximum value)"

The value of alert output accumulated pulses (minimum value) is calculated using the value of "Cd.16 Immediate stop accumulated pulse setting value (minimum value)" at the following condition:

"Cd.15 Alert output accumulated pulse setting value (minimum value)" > "Cd.16 Immediate stop accumulated pulse setting value (minimum value)"

Ex. When the setting values are as follows:

- Cd.13 Alert output accumulated pulse setting value (maximum value): 1200
- Cd.14 Immediate stop accumulated pulse setting value (maximum value): 1100
  Both alert output accumulated pulses and immediate stop accumulated pulses are judged by accumulated pulses that are 1.1 times of the reference value (maximum value). Thus, an alert is output and the positioning stops simultaneously.



### (c) Alert output accumulated pulse setting value, immediate stop accumulated pulse setting value, and "Accumulated pulse setting" in the switch setting

The setting range of "Cd.13 Alert output accumulated pulse setting value (maximum value)" and "Cd.15 Alert output accumulated pulse setting value (minimum value)" is 1000 to 50000 (1 to 50 times). However, when the alert output accumulated pulses exceed the amount of "Accumulated pulse setting" in the switch setting, an alert is output according to the setting of "Accumulated pulse setting"

The above is applicable to "Cd.14 Immediate stop accumulated pulse setting value (maximum value)" and "Cd.16 Immediate stop accumulated pulse setting value (minimum value)".

Ex. When the measured reference value (maximum value) is 2000 and the setting values are as follows:

- "Accumulated pulse setting" in the switch setting: -3700 to 3700 [selection 1]
- Cd.13 Alert output accumulated pulse setting value (maximum value): 3000 (3 times)

The calculated value of alert output accumulated pulses (maximum value) is 6000 (2000 + (3000 - 1000) × 2000 ÷ 1000). However, the value of alert output accumulated pulses (maximum value) becomes 3700 because the calculated value exceeds the amount of "Accumulated pulse setting"

# CHAPTER 12 STOPPING AND RESTARTING CONTROL

This chapter describes stops and restarts of control.

## 12.1 Stopping Control

This section describes control stops.

The QD73A1 stops control in case of the following.

- When each control ended normally
- When Servo READY signal (READY) turned off
- When an error occurred in the CPU module
- When PLC READY signal (Y2D) was turned off
- When an error occurred in the QD73A1
- When control was stopped intentionally (turning on Stop signal (Y27) or inputting Stop signal (STOP))
- When the upper limit switch (FLS) or the lower limit switch (RLS) turned off
- When the power supply was turned off

### (1) Cause of a stop and process of stopping

The following table describes causes of stops and the subsequent processing (except the stop in case of normal completion of positioning).

| Cause of stop | | Status of Error detection signal (X18) | Error | Process of stop |
|---|---|---|---|---|
| Forced stop | Servo READY signal (READY) turned off.*1 | ON | Servo READY OFF while BUSY (error code: 90) | Free run |
| | The power supply was turned off. | — | — | |
| Fatal stop | The upper limit switch (FLS) turned off. | ON | Upper limit signal OFF while BUSY (error code: 91) | Deceleration stop |
| | The lower limit switch (RLS) turned off. | | Lower limit signal OFF while BUSY (error code: 92) | |
| Emergency stop | PLC READY signal (Y2D) was turned off. | ON | PLC READY signal OFF during operation (error code: 105)*2 | |
| | | | PLC READY signal OFF during OPR (error code: 103)*3 | |
| Intentional stop | Stop signal (STOP) was input. | ON*3 | External stop signal ON during OPR (error code: 93)*3 | |
| | Stop signal (Y27) was turned on. | | STOP signal ON during OPR (error code: 102)*3 | |

*1 As Servo READY signal (READY) turned off, the analog voltage output from the QD73A1 changes to the value on which zero adjustment was made.

*2 Only during major positioning control or JOG operation

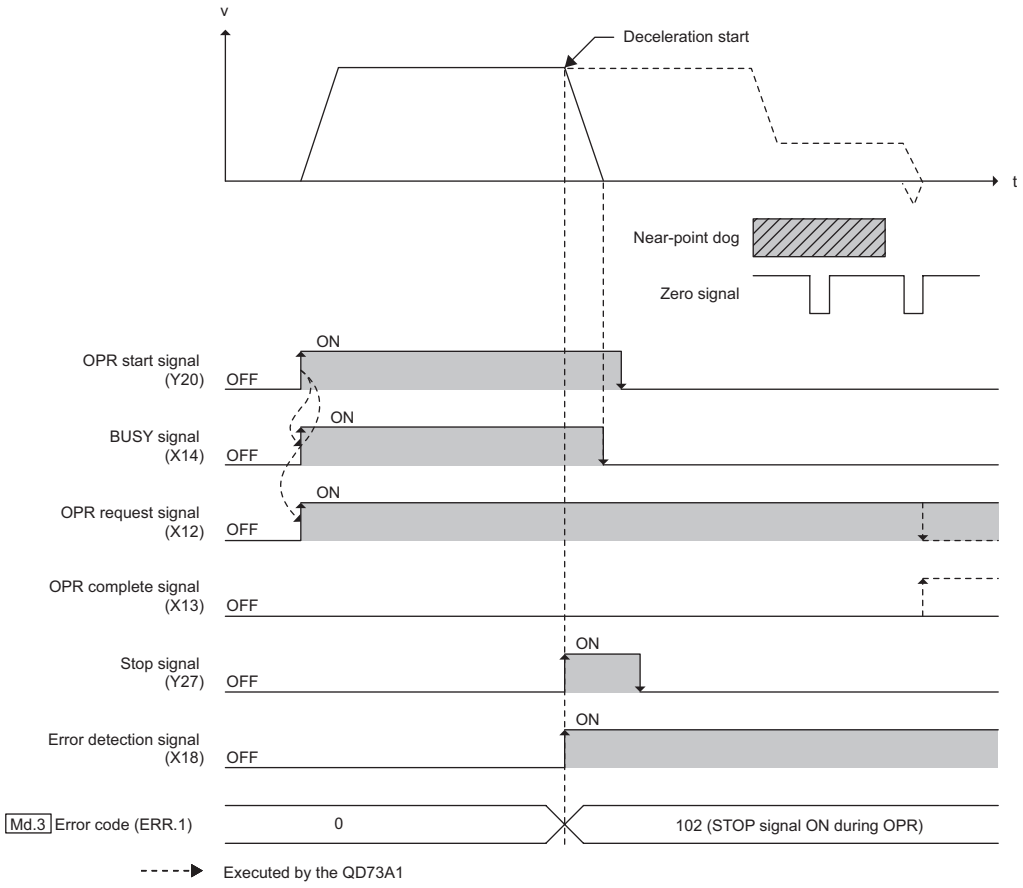
*3 Only during OPR

**Point**

An emergency stop circuit should be built outside the programmable controller.

## (2) Stop during OPR

If an error (a cause of a stop) occurs during OPR, a deceleration stop starts at the error occurrence.
At the completion of the deceleration stop, OPR request signal (X12) stays on. Also, OPR complete signal (X13) does not turn on since the OPR was not completed normally.
The following figure is the timing chart of when Stop signal (Y27) is turned on during OPR.



## (3) Stop during major positioning control or JOG operation

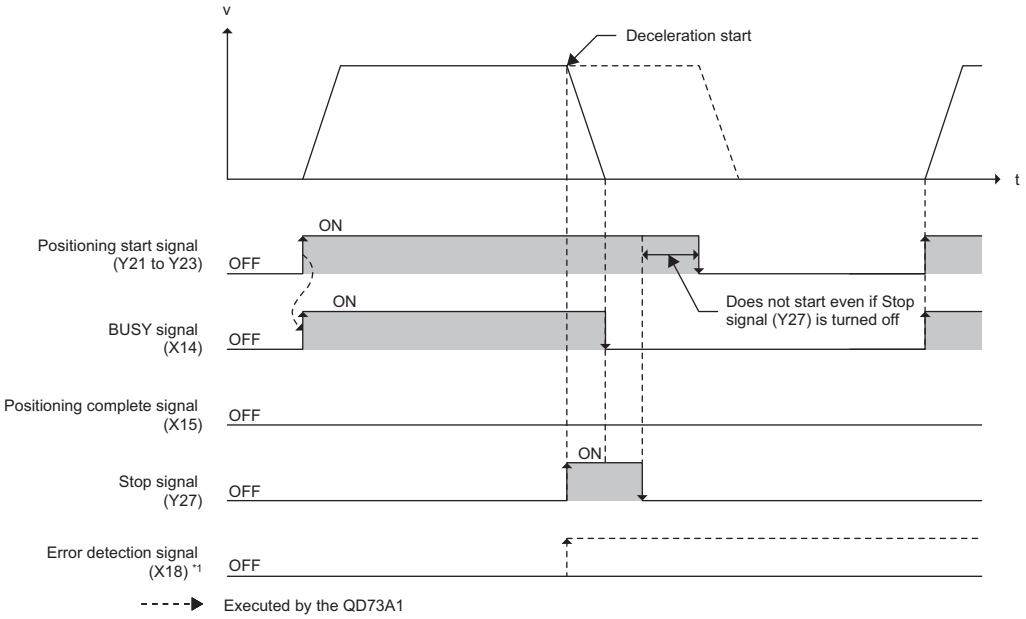
### (a) Stop before deceleration start of major positioning control or JOG operation

If an error (a cause of a stop) occurs prior to a start of deceleration during major positioning control or JOG operation, a deceleration stop starts at the error occurrence. The deceleration speed depends on "Pr.7 Deceleration time" and "Pr.5 Speed limit value".

Positioning complete signal (X15) does not turn on at the completion of the deceleration stop.

Also, the next positioning does not start even if the error is resolved while the start signal is on. The start signal must be turned off and on.

The following figure is the timing chart of when Stop signal (Y27) is turned on during positioning control.




*1 Error detection signal (X18) does not turn on in case of a stop following a change (from off to on) of Stop signal (Y27) or an input of Stop signal (STOP). Error detection signal (X18) turns on due to the following.

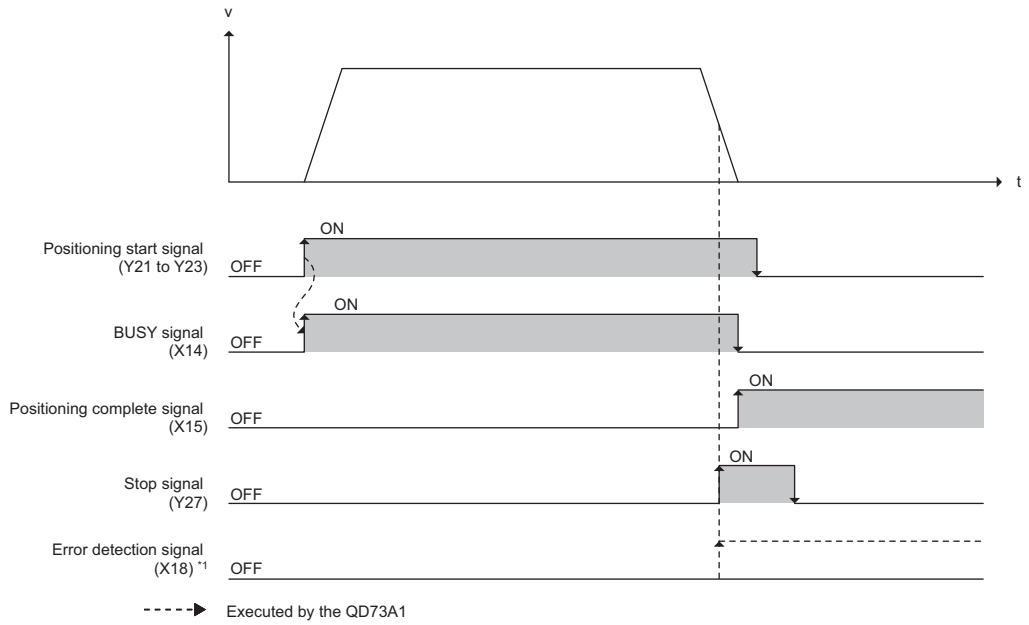
- Servo READY signal (READY) turned off.
- PLC READY signal (Y2D) was turned off.
- Upper limit signal (FLS) turned off.
- Lower limit signal (RLS) turned off.

### (b) Stop during deceleration of major positioning control or JOG operation

If an error (a cause of a stop) occurs during deceleration of major positioning control or JOG operation, the deceleration continues and the operation stops since it is toward completion of the positioning or is following a change (from on to off) of a JOG start signal (Y24, Y25). In case of major positioning control, Positioning complete signal (X15) turns on at its completion.

This process is the same for a stop with an error.

The following figure is the timing chart of when Stop signal (Y27) is turned on during deceleration of positioning control.




*1 Error detection signal (X18) does not turn on in case of a stop following a change (from off to on) of Stop signal (Y27) or an input of Stop signal (STOP). Error detection signal (X18) turns on due to the following.

- Servo READY signal (READY) turned off.
- PLC READY signal (Y2D) was turned off.
- Upper limit signal (FLS) turned off.
- Lower limit signal (RLS) turned off.

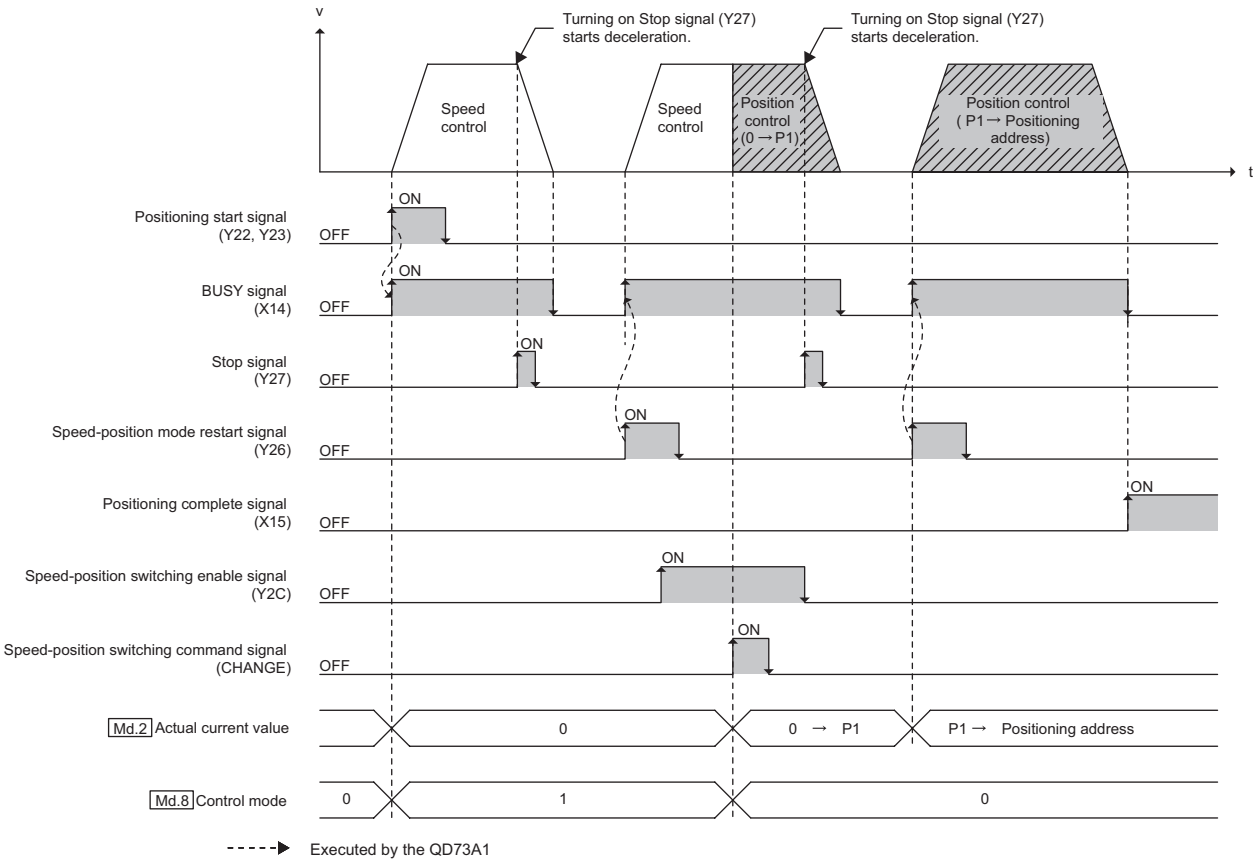
# 12.2 Restarting the Speed-position Control Switch Mode

After a deceleration stop following Stop signal, the operation of the speed-position control switch mode before the stop can be restarted by turning on Speed-position mode restart signal (Y26).

## (1) Control detail

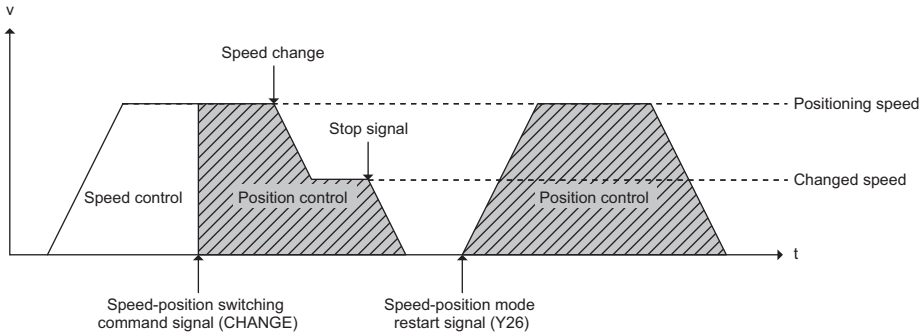
### (a) When positioning is stopped using Stop signal (Y27) or Stop signal (STOP)

The positioning before the stop can be restarted by turning on Speed-position mode restart signal (Y26).
The following figure shows the timing at which the speed-position control switch mode restarts.



### (b) When speed is changed during positioning

After a stop following the input of Stop signal (STOP), if Speed-position mode restart signal (Y26) is turned on, the positioning restarts according to the positioning speed set in the positioning data. The positioning does not restart at the new speed.




### (c) Precautions for control

- The following table indicates settings and start signal conditions to restart control. If Speed-position mode restart signal (Y26) is turned on in a condition "Restart possible", the error "Restart error" (error code: 85) occurs.

○: Restart possible
×: Restart not possible

| Start signal | "Pr.9 Positioning mode" | |
|---|---|---|
| | 0: Position control mode | 1: Speed-position control switch mode |
| OPR start signal (Y20) | × | × |
| Absolute positioning start signal (Y21) | × | × |
| Forward start signal (Y22) | × | ○ |
| Reverse start signal (Y23) | × | ○ |

- In the speed-position control switch mode, if Speed-position mode restart signal (Y26) is turned on in a status other than stop, the error "Restart error" (error code: 85) occurs and the axis does not act.

# CHAPTER 13 COMMON FUNCTIONS

Functions referred to as "common function" can be used regardless of control method when necessary.
Common functions can be used on GX Works2.

## 13.1 Module Status Monitor Function

The "module status monitor function" monitors the module information, switch setting information, and external I/O signal information. The module's detailed information can be displayed on the system monitor of GX Works2.

### (1) Hardware LED information

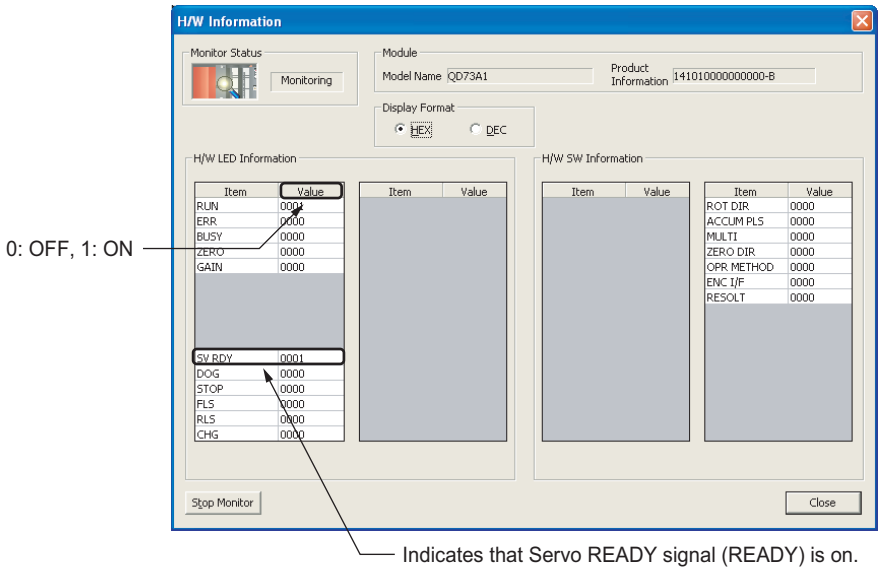
The following LED statuses are displayed.

| Item | Value | Condition to be $0001_H$ |
|---|---|---|
| RUN | • $0000_H$: Indicates that the LED is off.<br>• $0001_H$: Indicates that the LED is on. | Operating normally (same as the RUN LED) |
| ERR | | Error occurrence |
| BUSY | | During positioning |
| ZERO | | Adjusting zero |
| GAIN | | Adjusting gain |
| SV RDY | | Servo READY signal (READY) ON |
| DOG | | Near-point dog signal (DOG) ON |
| STOP | | Stop signal (STOP) ON |
| FLS | | Upper limit signal (FLS) ON |
| RLS | | Lower limit signal (RLS) ON |
| CHG | | Speed-position switching command signal (CHANGE) ON |

## (2) Hardware switch information

The following switch setting statuses are displayed.

| Item | Switch setting | Value |
|---|---|---|
| ROT DIR | Rotation direction setting | Refer to Page 272, Appendix 4.1 (2). |
| ACCUM PLS | Accumulated pulse setting | |
| MULTI | Multiplication setting | |
| ZERO DIR | OPR direction setting | |
| OPR METHOD | OPR method setting | |
| ENC I/F | Encoder I/F setting | |
| RESOLT | Analog voltage resolution setting | |

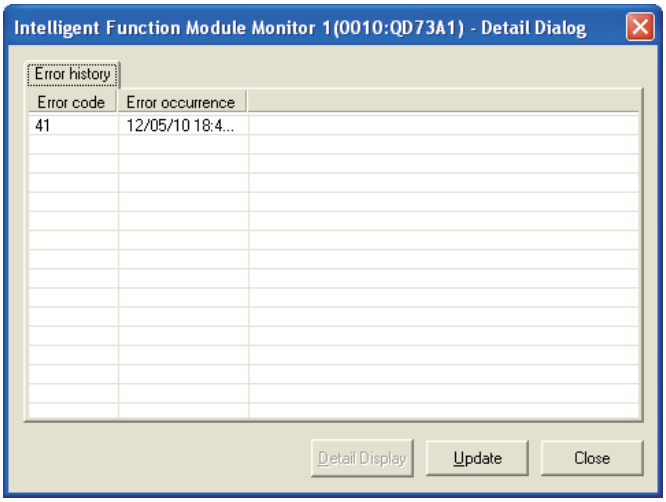



For details on the system monitor of GX Works2, refer to the following.

GX Works2 Version1 Operating Manual (Common)

# 13.2 Error History Function

This function monitors the QD73A1's error history stored in the buffer memory.
The error history of past 16 records can be monitored. Once 16 records are stored, the next record overwrites the oldest record. Therefore, the latest 16 errors are stored at all times.




To check the error history, the QD73A1 needs to be registered in the intelligent function module monitor window. For how to register the module in the intelligent function module monitor window and to display the details of the history, refer to the following.

GX Works2 Version1 Operating Manual (Intelligent Function Module)

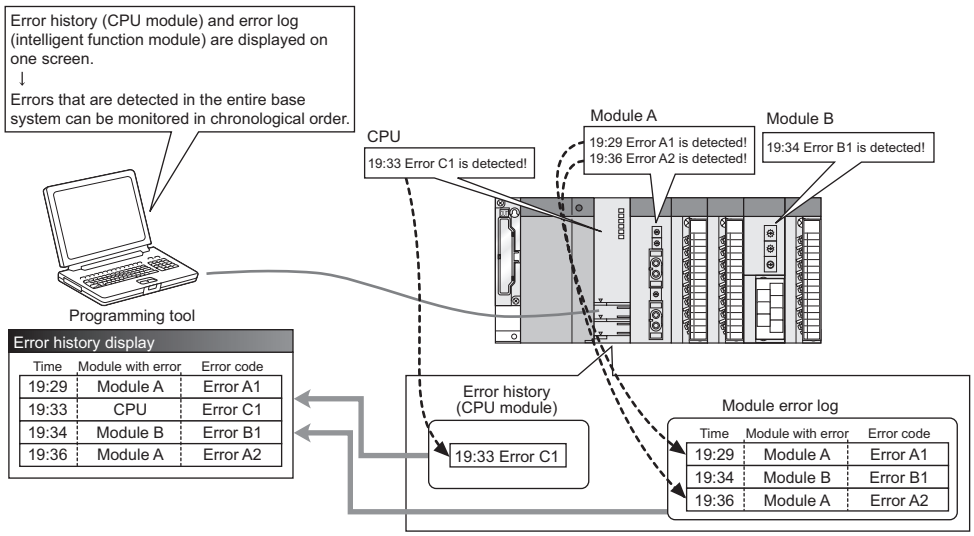
To monitor the error history directly through the buffer memory, refer to the following.

Page 86, Section 5.5

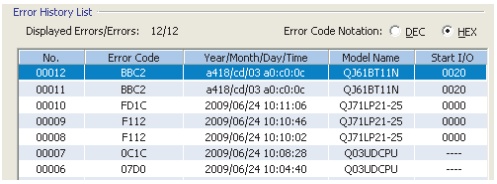
# 13.3 Module Error Collection Function

Errors that occurred in the QD73A1 are collected into the CPU module.

The error information of the QD73A1 module is held in a CPU module memory as a module error history, even when the power is turned off or the CPU module is reset.


Error history (CPU module) and error log (intelligent function module) are displayed on one screen.
↓
Errors that are detected in the entire base system can be monitored in chronological order.
CPU
19:33 Error C1 is detected!
Module A
19:29 Error A1 is detected!
19:36 Error A2 is detected!
Module B
19:34 Error B1 is detected!
Programming tool
Error history display
Time Module with error Error code
19:29 Module A Error A1
19:33 CPU Error C1
19:34 Module B Error B1
19:36 Module A Error A2
Error history (CPU module)
19:33 Error C1
Module error log
Time Module with error Error code
19:29 Module A Error A1
19:34 Module B Error B1
19:36 Module A Error A2

[Example of screen display]




For details on the module error collection function, refer to the following.

☞Page 239, Section 14.1

# 13.4 Error Clear Function

When an error occurs, the error can be cleared on the system monitor.

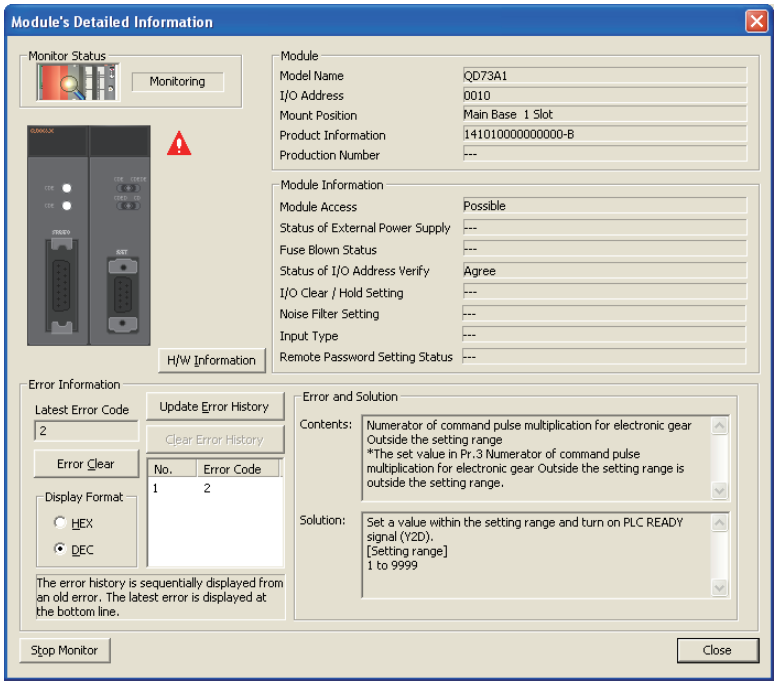
By clicking the Error Clear button in the system monitor, the error codes stored in "Md.3 Error code (ERR.1)" and "Md.4 Error code (ERR.2)" are cleared, and the ERR. LED turns off. This operation is the same as the one that uses Error reset signal (Y28).

However, the error history cannot be cleared with the button.

For the error clearing method using Error reset signal (Y28), refer to the following.

☞ Page 39, Section 3.4.3 (12)

[Diagnostics]➪[System Monitor...]➪Error module



# CHAPTER 14 TROUBLESHOOTING

This chapter describes errors that may occur in the QD73A1 and troubleshooting for them.

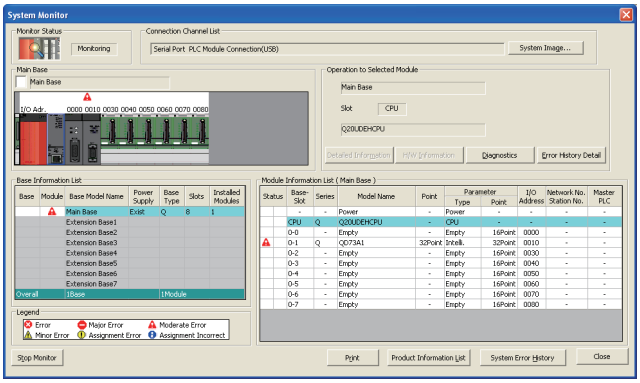
## 14.1 Checking an Error on GX Works2

The error codes that occurred in the QD73A1 can be checked by the following.
Choose a method depending on the purpose and application.

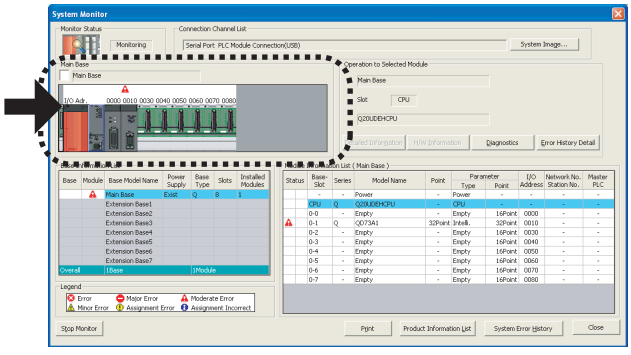
- Checking on the "Module's Detailed Information" window
- Checking on the "Error History" window

### (1) Checking on the "Module's Detailed Information" window

Follow the procedure below.




↓




↓

(To the next page)

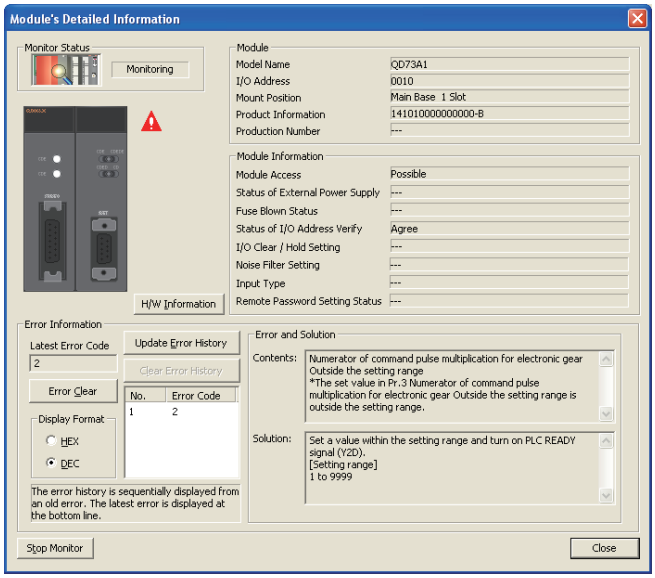
***1.*** **Connect GX Works2 to the CPU module, and display the "System Monitor" window.**

[Diagnostics]⇨[System Monitor...]

***2.*** **After confirming that an error is displayed on the QD73A1, select the QD73A1 and click the** Detailed Information **button.**

**When an error is indicated on a module other than the QD73A1, refer to the user's manual for the module and take a corrective action.**

(From the previous page)
↓

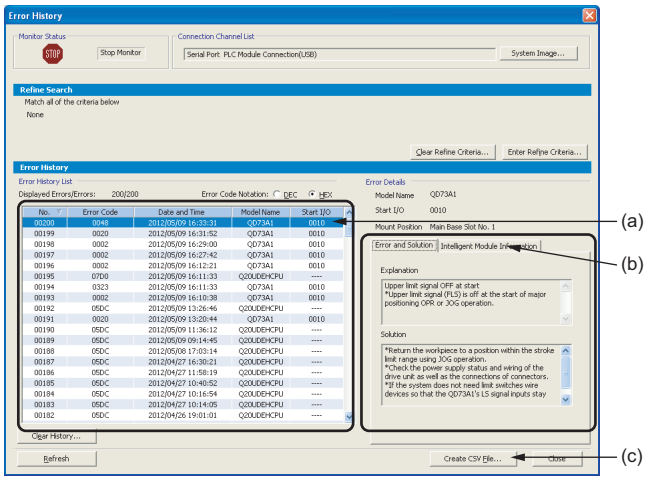

Module's Detailed Information
Monitor Status
Monitoring
Module
Model Name QD73A1
I/O Address 0010
Mount Position Main Base 1 Slot
Product Information 141010000000000-B
Production Number ---
Module Information
Module Access Possible
Status of External Power Supply ---
Fuse Blown Status ---
Status of I/O Address Verify Agree
I/O Clear / Hold Setting ---
Noise Filter Setting ---
Input Type ---
Remote Password Setting Status ---
H/W Information
Error Information
Latest Error Code
2
Update Error History
Clear Error History
Error Clear
No. Error Code
1 2
Display Format
HEX
DEC
The error history is sequentially displayed from an old error. The latest error is displayed at the bottom line.
Error and Solution
Contents:
Numerator of command pulse multiplication for electronic gear Outside the setting range
*The set value in Pr.3 Numerator of command pulse multiplication for electronic gear Outside the setting range is outside the setting range.
Solution:
Set a value within the setting range and turn on PLC READY signal (Y2D).
[Setting range]
1 to 9999
Stop Monitor
Close

***3.*** **Click the Detailed Information button to display the "Module's Detailed Information" window.**
**The error detail and solution can be checked under "Error and Solution"**

## (2) Checking on the "Error History" window

An error history that includes errors in the QD73A1 and other modules is displayed in a list, and it can be output to a CSV file. The error codes and the error occurrence time can be checked even after the power was turned off and on or the CPU module was reset.

[Diagnostics]⇨[System Monitor...]⇨ System Error History button


Error History
Monitor Status
Stop Monitor
Connection Channel List
Serial Port: PLC Module Connection(USB)
System Image...
Refine Search
Match all of the criteria below
None
Clear Refine Criteria...
Enter Refine Criteria...
Error History
Error History List
Displayed Errors/Errors: 200/200
Error Code Notation: DEC HEX
No. Error Code Date and Time Model Name Start I/O
00200 0048 2012/05/09 16:33:31 QD73A1 0010
00199 0020 2012/05/09 16:31:52 QD73A1 0010
00198 0002 2012/05/09 16:29:00 QD73A1 0010
00197 0002 2012/05/09 16:27:42 QD73A1 0010
00196 0002 2012/05/09 16:12:21 QD73A1 0010
00195 07D0 2012/05/09 16:11:33 Q20UDEHCPU ----
00194 0323 2012/05/09 16:11:33 QD73A1 0010
00193 0002 2012/05/09 16:10:38 QD73A1 0010
00192 05DC 2012/05/09 13:26:46 Q20UDEHCPU ----
00191 0020 2012/05/09 13:20:44 QD73A1 0010
00190 05DC 2012/05/09 11:36:12 Q20UDEHCPU ----
00189 05DC 2012/05/09 09:14:45 Q20UDEHCPU ----
00188 05DC 2012/05/08 17:03:14 Q20UDEHCPU ----
00187 05DC 2012/04/27 16:30:21 Q20UDEHCPU ----
00186 05DC 2012/04/27 11:58:19 Q20UDEHCPU ----
00185 05DC 2012/04/27 10:40:52 Q20UDEHCPU ----
00184 05DC 2012/04/27 10:16:54 Q20UDEHCPU ----
00183 05DC 2012/04/27 10:14:05 Q20UDEHCPU ----
00182 05DC 2012/04/26 19:01:01 Q20UDEHCPU ----
Error Details
Model Name QD73A1
Start I/O 0010
Mount Position Main Base Slot No. 1
Error and Solution
Intelligent Module Information
Explanation
Upper limit signal OFF at start
*Upper limit signal (FLS) is off at the start of major positioning OPR or JOG operation.
Solution
*Return the workpiece to a position within the stroke limit range using JOG operation.
*Check the power supply status and wiring of the drive unit as well as the connections of connectors.
*If the system does not need limit switches wire devices so that the QD73A1's LS signal inputs stay
Clear History...
Refresh
Create CSV File...
Close
(a)
(b)
(c)

### (a) Error History List

Error logs of modules are displayed in a list.

### (b) Error and Solution, Intelligent Module Information

- Error and Solution: Displays the detail and corrective action for the error selected on "Error History List".
- Intelligent Module Information: Displays the QD73A1's status at the occurrence of the error selected on "Error History List".

For the QD73A1, the following are displayed.

| Item | Description |
|---|---|
| Current feed value | The current value at the time of the error occurrence is stored. |
| Actual current value | The actual current value at the time of the error occurrence is stored. |
| State of the input signal (Xn0 to XnF) | The status of input signals (X0 to XF) at the time of error occurrence is stored (in hexadecimal). |
| State of the input signal (X(n+1)0 to X(n+1)F) | The status of input signals (X10 to X1F) at the time of error occurrence is stored (in hexadecimal). |
| State of the output signal (Yn0 to YnF) | The status of output signals (Y0 to YF) at the time of error occurrence is stored (in hexadecimal). |
| State of the output signal (Y(n+1)0 to Y(n+1)F) | The status of output signals (Y10 to Y1F) at the time of error occurrence is stored (in hexadecimal). |
| WDT error H/W error signal | The statuses of input signals (X) at the time of error occurrence are stored. |
| QD73A1 READY signal | |
| OPR request signal | |
| OPR complete signal | |
| BUSY signal | |
| Positioning complete signal | |
| In-position signal | |
| Excessive error signal | |
| Error detection signal | |
| Overflow signal | |
| Underflow signal | |
| Servo READY signal | |
| Near-point dog signal | |
| External stop signal | |
| Upper limit signal | |
| Lower limit signal | |
| OPR start complete signal | |
| Absolute positioning start complete signal | |
| Forward start complete signal | |
| Reverse start complete signal | |
| Synchronization flag | |
| Zero/gain adjustment data writing complete flag | |
| Zero/gain adjustment change complete flag | |
| Set value change complete signal | |
| Operating status of the speed-position control switch mode | |

### (c) Button to create a CSV file

An error history is output to a CSV file.

**Point**

If errors occur in the QD73A1 frequently, "*HST.LOSS*" may be displayed under "Error Code" instead of an actual error code.

| No. | Error Code | Date and Time | Model Name | Start I/O |
|---|---|---|---|---|
| 00126 | *HST.LOSS* | 2012/02/15 14:22:49 | QD73A1 | 0010 |
| 00125 | 0C4E | 2012/02/15 14:10:30 | Q10UDHCPU | ---- |

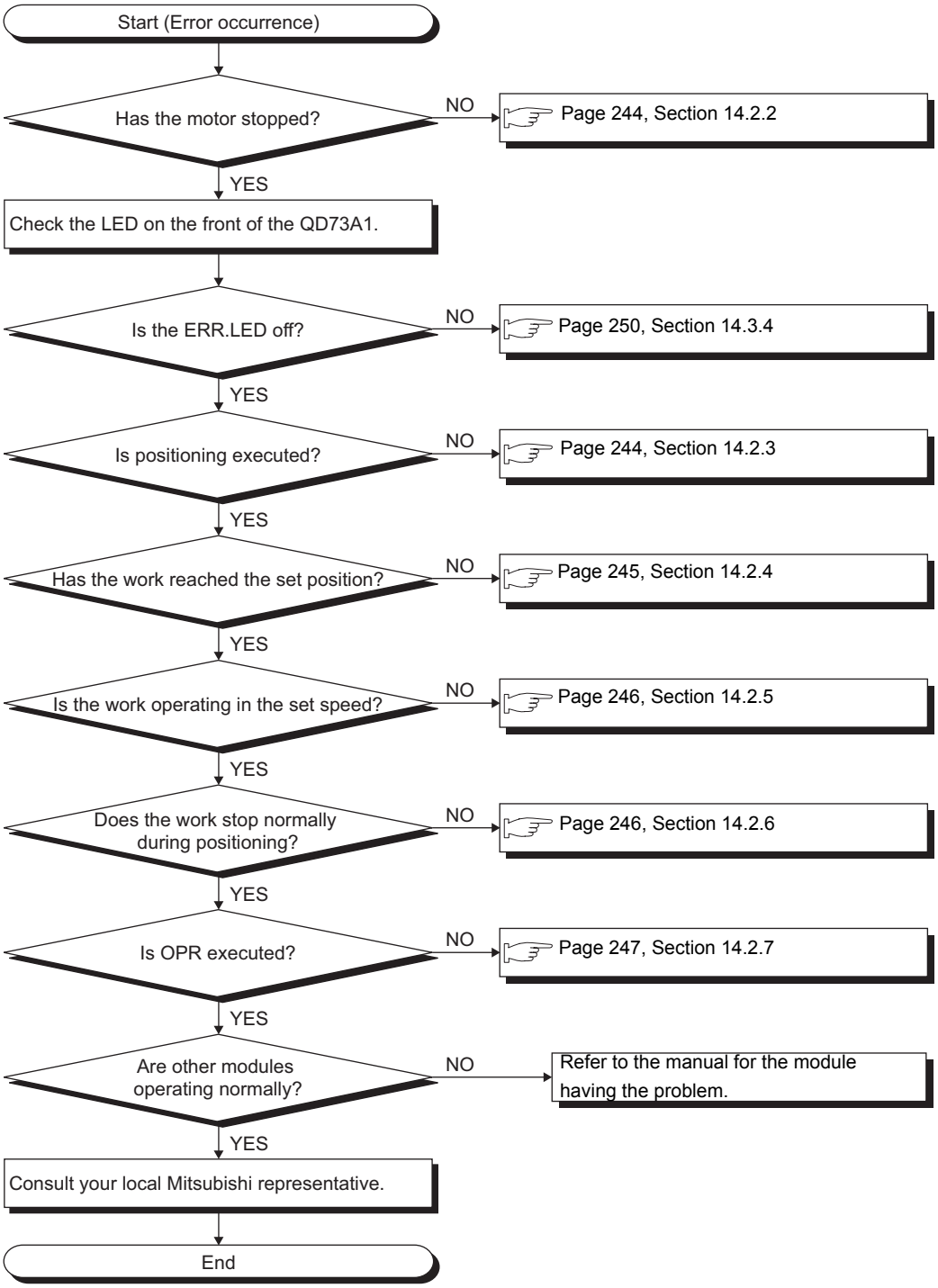
If "*HST.LOSS*" is displayed frequently, set a large value for the number of errors collected per scan under the "PLC RAS" tab in "PLC Parameter". For the setting, refer to the following.

The user's manual (Function Explanation, Program Fundamentals) for the CPU module used

# 14.2 Troubleshooting

## 14.2.1 Troubleshooting procedure

This section shows the troubleshooting procedure for the QD73A1.



## 14.2.2 When the motor does not stop

| Check item | Action |
|---|---|
| Is the QD73A1's zero adjustment performed properly? | Perform zero adjustment. (☞ Page 60, Section 4.5) |
| Is the servo amplifier's zero adjustment performed properly? | Refer to the manual for the servo amplifier, and perform zero adjustment. |
| Is a large value set to the gain value of the servo amplifier? | Refer to the manual for the servo amplifier, and adjust the gain value of the servo amplifier to a proper value. |
| Are the speed command terminal on the QD73A1 and the servo amplifier connected properly?<br>(when the motor does not stop even though the speed command from the QD73A1 is 0V) | Connect the speed command terminals properly. |
| Is there noise effect? | • Place signal lines away from power cables.<br>• Use shielded twisted pair cables for signal lines.<br>• Ground cables without fail.<br>• Place the motor away from noise source. |

## 14.2.3 When positioning cannot be executed

| Check item | Action |
|---|---|
| Is PLC READY signal (Y2D) off? | Turn on PLC READY signal (Y2D). |
| Is Servo READY signal (X1B) off? | • Turn on Servo READY signal.<br>• Check if there is any error on the servo amplifier.<br>• Check if the QD73A1 and the servo amplifier are wired properly. |
| Is the ERR. LED on? | Read out the error code, and take the corrective action described in the error code list.<br>(☞ Page 250, Section 14.3.4) |
| Is the BUSY LED off? | [Double-check the sequence program.]<br>• Check if an interlock is made at a start.<br>• Check if Stop signal (Y27) is on.<br>• Check if the start is kept reset.<br>• Check if the start signal is kept on. |
| | [Check the QD73A1's status.]<br>• Check if the QD73A1 is mounted on the base unit properly.<br>• Check if the position setting is proper. |
| Is Excessive error signal (X17) on? | The accumulated pulse amount is outside the setting range.<br>• Check if the accumulated pulse setting is proper. (☞ Page 102, Section 6.2.2)<br>• Check if the multiplication setting is proper. (☞ Page 104, Section 6.2.3)<br>• Check if the encoder I/F setting is proper. (☞ Page 105, Section 6.2.6)<br>• Check if the gain adjustment is proper. (☞ Page 60, Section 4.5)<br>• Check if the QD73A1 and the encoder are connected properly. (☞ Page 67, Section 4.6.2) |
| Is External stop signal (X1D) on? | • Check if Stop signal (Y27) is on.<br>• Check if Stop signal (STOP) is on. |
| Is WDT error, H/W error signal (X10) on? | If WDT error, H/W error signal (X10) stays on even after resetting the CPU module, please consult your local Mitsubishi representative. |
| Are the QD73A1 and the drive unit connected properly? | Check if the QD73A1 and the drive unit are wired properly. |

| Check item | Action |
|---|---|
| Is proper wave output displayed when the QD73A1's speed command terminal is connected to an oscilloscope? | If proper wave output is not displayed, please consult your local Mitsubishi representative. |
| Is proper wave output displayed when the drive unit's encoder output terminal is connected to an oscilloscope? | |

## 14.2.4 When a positioning error occurs

| Check item | Action |
|---|---|
| Do the position errors occur by regular amount? | [Double-check the parameters.]<br>• Check if the set position is proper according to the machine position.<br>• Check the positioning parameters and positioning data.<br>• Check the accumulated pulse setting. (☞ Page 102, Section 6.2.2)<br>• Check the multiplication setting. (☞ Page 104, Section 6.2.3) |
| | [Double-check the sequence program.]<br>• Check if a proper address is set.<br>• Check if a proper value is set for a current value change.<br>• Check if a stop signal is input.<br>• Check if the set movement amount is too small for operation in the speed-position control switch mode. |
| Is the motor rotating smoothly? | Check if the feedback pulse frequency is within 1Mpulse/s using an oscilloscope. |
| Is there noise effect? | • Place signal lines away from power cables.<br>• Use shielded twisted pair cables for signal lines.<br>• Ground cables without fail.<br>• Place each device in the system away from noise source. |

## 14.2.5 When the positioning speed is different from the specified speed

| Check item | Action |
|---|---|
| Are the positioning data set properly? | Set proper positioning data. |
| Is the set positioning speed value greater than "Pr.5 Speed limit value"? | Set a positioning speed value that is smaller than "Pr.5 Speed limit value". |
| Is the accumulated pulse setting proper? | Calculate the maximum accumulated pulse amount, and review the accumulated pulse setting. (☞ Page 102, Section 6.2.2) |
| Is the zero/gain adjustment proper? | Perform zero/gain adjustment again. (☞ Page 60, Section 4.5) |
| Is the multiplication setting proper? | Configure the multiplication setting properly. (☞ Page 104, Section 6.2.3) |
| Is the servo amplifier set properly? | Refer to the manual for the servo amplifier, and set the servo amplifier properly. |
| Is a speed change executed? | Review the sequence program to see if the speed change is necessary. |
| Is proper wave output displayed when the QD73A1's speed command terminal is connected to an oscilloscope? | If proper wave output is not displayed, please consult your local Mitsubishi representative. |
| Is proper wave output displayed when the drive unit's encoder output terminal is connected to an oscilloscope? | |

## 14.2.6 When operation stops abnormally during positioning

| Check item | Action |
|---|---|
| Is there an error on the servo amplifier? | Refer to the manual for the servo amplifier, and check the error detail. |
| Is Stop signal (Y27) on? | Review the sequence program to see if Stop signal (Y27) needs to be turned on. |
| Is Stop signal (STOP) on? | Check if Stop signal (STOP) is wired properly. |
| Is Excessive error signal (X17) on? | The accumulated pulse amount is outside the setting range.<br>Check if the accumulated pulse setting is proper. (☞ Page 102, Section 6.2.2) |
| Is there noise effect? | • Place signal lines away from power cables.<br>• Use shielded twisted pair cables for signal lines.<br>• Ground cables without fail.<br>• Place each device in the system away from noise source. |

# 14.2.7 OPR error

## (1) When OPR cannot be completed

| Check item | Action |
|---|---|
| Does Near-point dog signal (DOG) stay off? | Check if Near-point dog signal (DOG) is wired properly. |
| Does the speed change to the creep speed after Near-point dog signal (DOG) turned on? | The QD73A1 may be broken. Please consult your local Mitsubishi representative. |
| Does analog output from the QD73A1 continue after a Zero signal input? | |
| Does Zero signal stay off? | Check if Zero signal is wired properly. |

## (2) When the OP position is in error

| Check item | Action |
|---|---|
| Do the position errors occur by regular amount? | [Near-point dog method]<br>If the position where the near-point dog turns off is near the position of a Zero signal input, the Zero signal input may be misread. Adjust the position where the near-point dog turns off to be closer to the center of Zero signals. |
| | [Count method]<br>If the position after the move according to " Pr.13 Setting for the movement amount after near-point dog ON" is near the position of a Zero signal input, the Zero signal input may be misread. Adjust " Pr.13 Setting for the movement amount after near-point dog ON" so that the position after the move becomes closer to the center of Zero signals. |
| Is the OPR completed near the position where Near-point dog signal (DOG) turns on? | Near-point dog signal (DOG) may be chattering. Use a high-performance near-point dog. |
| Is the OPR in the near-point dog method completed even though the near-point dog did not turn off? | The contact or wiring of the near-point dog is not proper. Check the wiring. |
| In the near-point dog method, is the movement amount after near-point dog ON more than that of normal OPR completion by one or more servomotor rotation? | Near-point dog signal (DOG) may be chattering when it turns off. Use a high-performance near-point dog. |

# 14.3 Details of Errors

## 14.3.1 Types of errors

The errors detected in the QD73A1 are categorized into five types.

### (1) Setting data range error

The QD73A1 checks parameters with the setting ranges at the following timings, and detects an error when a data is outside the setting range. If an error occurs, the corresponding data must be changed to a value within the setting range.

| Setting data | Check timing |
|---|---|
| Fixed parameters | When PLC READY signal (Y2D) is turned on |
| Variable parameters | When a positioning start signal (Y21 to Y23) is turned on |
| | When a JOG start signal (Y24, Y25) is turned on |
| | When OPR start signal (Y20) is turned on |
| OPR parameters | When OPR start signal (Y20) is turned on |
| Positioning data | When a positioning start signal (Y21 to Y23) is turned on |
| Control change areas | Before the execution of a control change |

### (2) Start error

Start error is a type of errors that occur at a start of OPR control, major positioning control, or JOG operation. Operation does not start if an error occurs.

### (3) Operation error

Operation error is a type of errors that occur during OPR control, major positioning control, or JOG operation. If an error occurs, operation decelerates and stops or continues without decelerating depending on the error detail.

For the operation at the error occurrence, refer to the following.

(☞Page 250, Section 14.3.4)

### (4) Control change error

Control change error is a type of errors that occur at a control change during positioning.

The data for the control change is ignored if an error occurs.

### (5) Zero/gain adjustment error

Zero/gain adjustment error is a type of errors that occur during zero/gain adjustment.

The details of the zero/gain adjustment are not reflected in the QD73A1 if an error occurs. Eliminate the error cause, and perform zero/gain adjustment again.

## 14.3.2 Storage of errors

When an error occurs in the QD73A1, the corresponding error code is stored in the buffer memory.

### (1) ERR.1 and ERR.2

Errors are classified into ERR.1 and ERR.2 depending on the error details.

| Error classification | Description |
|---|---|
| ERR.1 (minor errors) | Errors caused due to sequence programs.<br>Check the error code, and eliminate the error cause by correcting the sequence program. |
| ERR.2 (major errors) | Hardware errors or errors caused due to control commands from external input signals.<br>Check the error code, and eliminate the error cause on an external input signal. |

### (2) Buffer memory areas for error codes

The latest error codes are stored in the following buffer memory areas every time an error occurs, deleting the previous error codes. When there is no error or when the errors were reset, "0" is stored.

| Error classification | Buffer memory area name | Buffer memory address | Corresponding error detection signal |
|---|---|---|---|
| ERR.1 (minor errors) | Md.3 Error code (ERR.1) | 104 | Error detection signal (X18) |
| ERR.2 (major errors) | Md.4 Error code (ERR.2) | 105 | |

## 14.3.3 Error reset

Eliminate the error cause according to the corrective action described in the error code list (☞Page 250, Section 14.3.4), then cancel the error status by turning on Error reset signal (Y28).
At the time, the QD73A1 operates as follows.

| | |
|---|---|
| 1 | Clears " Md.3 Error code (ERR.1)" to 0. |
| 2 | Clears " Md.4 Error code (ERR.2)" to 0. |
| 3 | Turns off Error detection signal (X18). |

## 14.3.4 Error code list

The following table describes error details and corrective actions.

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Setting data range error (Fixed parameter) | 1 | ERR.1 | Stroke limit lower limit | The set value in "Pr.2 Stroke limit lower limit" is outside -2147483648 to "Pr.1 Stroke limit upper limit". | If a setting is outside the setting range, the error occurs and all of the fixed parameters use the default values for the control. | Set a value within the setting range, and turn on PLC READY signal (Y2D). |
| | 2 | | Numerator of command pulse multiplication for electronic gear Outside the setting range | The set value in "Pr.3 Numerator of command pulse multiplication for electronic gear" is outside the setting range. | | Set a value within the setting range, and turn on PLC READY signal (Y2D).<br>[Setting range]<br>1 to 9999 |
| | 3 | | Denominator of command pulse multiplication for electronic gear Outside the setting range | The set value in "Pr.4 Denominator of command pulse multiplication for electronic gear" is outside the setting range. | | Set a value within the setting range, and turn on PLC READY signal (Y2D).<br>[Setting range]<br>1 to 9999, and besides 1/50 ≤ CMX/CDV ≤ 50 |
| Setting data range error (Variable parameter) | 10 | | Speed limit value Outside the setting range | The set value in "Pr.5 Speed limit value" is outside the setting range. | Only the setting with the error uses the default value for control. | Set a value within the setting range.<br>[Setting range]<br>10 to 4000000pulse/s |
| | 11 | | Acceleration time Outside the setting range | The set value in "Pr.6 Acceleration time" is outside the setting range. | | Set a value within the setting range.<br>[Setting range]<br>2 to 9999ms |
| | 12 | | Deceleration time Outside the setting range | The set value in "Pr.7 Deceleration time" is outside the setting range. | | Set a value within the setting range.<br>[Setting range]<br>2 to 9999ms |
| | 13 | | In-position range Outside the setting range | The set value in "Pr.8 In-position range" is outside the setting range. | | Set a value within the setting range.<br>[Setting range]<br>1 to 20479pulse |
| | 14 | | Positioning mode Outside the setting range | The set value in "Pr.9 Positioning mode" is other than 0 and 1. | | Set a value within the setting range. |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Setting data range error (OPR parameter) | 20 | ERR.1 | OPR speed Outside the setting range | The set value in "Pr.11 OPR speed" is outside the setting range. | If a setting is outside the setting range, the OPR does not start. | Set a value within the setting range.<br>[Setting range]<br>1 to "Pr.5 Speed limit value" (pulse/s) |
| | 21 | | Creep speed Outside the setting range | The set value in "Pr.12 Creep speed" is outside the setting range. | | Set a value within the setting range.<br>[Setting range]<br>1 to "Pr.11 OPR speed" (pulse/s) |
| | 22 | | Setting for the movement amount after near-point dog ON Outside the setting range | The set value in "Pr.13 Setting for the movement amount after near-point dog ON" is outside the setting range. | | Set a value within the setting range.<br>[Setting range]<br>Deceleration distance from "Pr.11 OPR speed" to "Pr.12 Creep speed" < "Pr.13 Setting for the movement amount after near-point dog ON" (This condition is checked only in the count method.) |
| Setting data range error (Positioning data) | 30 | | Positioning address Outside the setting range | • The positioning end point is outside the stroke limit range.<br>• The set value of positioning address in the incremental system is a negative value at the start. | The positioning does not start. | • Set the positioning end point within the stroke limit range.<br>• Do not set a negative value to the positioning address in the incremental system at the start. |
| | 31 | | Two-phase trapezoidal positioning address error | For two-phase trapezoidal positioning control in the absolute system, the moving direction from P1 to P2 is different from the direction used to reach P1. | | Do not change the moving direction for P1 to P2 from the direction used to reach P1. |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Setting data range error (Positioning data) | 32 | ERR.1 | Positioning speed Outside the setting range | The positioning speed is outside the setting range. | The positioning does not start when the set value is 0. In case of an error due to a set value other than 0, the positioning is controlled with "Pr.5 Speed limit value". | Set a value within the setting range.<br>[Setting range]<br>1 to "Pr.5 Speed limit value" (pulse/s) |
| Setting data range error (Control change area) | 40 | | New speed value Outside the setting range | The set value in "Cd.2 New speed value" is outside the setting range in positioning operation. | | Set a value within the setting range.<br>[Setting range]<br>0 to "Pr.5 Speed limit value" (pulse/s) |
| Setting data range error (Control change area) | 41 | | JOG speed Outside the setting range | The set value in "Cd.3 JOG speed" is outside the setting range. | | Set a value within the setting range.<br>[Setting range]<br>1 to "Pr.5 Speed limit value" (pulse/s) |
| Start error | 70 | ERR.2 | Servo READY OFF at start | Servo READY signal (READY) is off at the start of major positioning, OPR, or JOG operation. | The operation does not start. | • Check the power supply status and wiring of the drive unit, as well as the connections of connectors.<br>• When using a drive unit without Servo READY output, wire devices so that the QD73A1's Servo READY signal (READY) input stays on. |
| | 71 | | External stop signal ON at start | Stop signal (STOP) is on at the start of major positioning, OPR, or JOG operation. | | Turn off Stop signal (STOP). |
| | 72 | | Upper limit signal OFF at start | Upper limit signal (FLS) is off at the start of major positioning, OPR, or JOG operation. | | • Return the workpiece to a position within the stroke limit range using JOG operation.<br>• Check the power supply status and wiring of the drive unit, as well as the connections of connectors.<br>• If the system does not need limit switches, wire devices so that the QD73A1's LS signal inputs stay on. |
| | 73 | | Lower limit signal OFF at start | Lower limit signal (RLS) is off at the start of major positioning, OPR, or JOG operation. | | |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Start error | 74 | ERR.2 | Near-point dog signal ON at start | Near-point dog signal (DOG) is on at the start of OPR in the near-point dog method. | The operation does not start. | Return the workpiece to a position away from the near-point dog using JOG operation or major positioning, then execute OPR. |
| | 80 | ERR.1 | READY signal OFF at start (PLC READY signal OFF at start) | QD73A1 READY signal (X11) or PLC READY signal (Y2D) is off at the start of major positioning, OPR, or JOG operation. | | Turn on PLC READY signal (Y2D). |
| | 81 | | BUSY signal ON at start | An operation start is attempted when BUSY signal (X14) is on. | | Make an interlock using a sequence program so that no operation starts when BUSY signal (X14) is on. |
| | 82 | | STOP signal ON at start | An operation start is attempted when Stop signal (Y27) is on. | | Turn off Stop signal (Y27), and start the operation again. |
| | 83 | | Outside the stroke limit range at start | An operation start is attempted when the workpiece is outside the stroke limit range. | | • Return the workpiece to a position within the stroke limit range using JOG operation.<br>• Execute OPR.<br>• Set the workpiece to a position within the stroke limit range by changing the current value. |
| | 84 | | OPR complete signal ON at start | An OPR start is attempted when OPR complete signal (X13) is on. | | • OPR cannot be started in succession (only in the near-point dog method).<br>• Move the workpiece to the position before the near-point dog using JOG operation or major positioning, then start another OPR. |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Start error | 85 | ERR.1 | Restart error | Speed-position mode restart signal (Y26) was turned on when positioning was complete in the speed-position control switch mode. | The operation does not start. | Start operation using Forward start signal (Y22) or Reverse start signal (Y23). |
| | | | | Speed-position mode restart signal (Y26) was turned on in the position control mode. | | Start operation using Absolute positioning start signal (Y21), Forward start signal (Y22), or Reverse start signal (Y23). |
| Operation error | 87 | ERR.1 | Movement outside the stroke limit range | A movement amount change was attempted with a value that moves the workpiece outside the stroke limit range. | The movement amount does not change. | Set movement amount so that the workpiece is positioned within the stroke limit range after the move. |
| | 90 | ERR.2 | Servo READY OFF while BUSY | Servo READY signal (READY) turned off during major positioning, OPR, or JOG operation. | The operation runs freely. | Check the drive unit, and turn on Servo READY signal (READY). |
| | 91 | | Upper limit signal OFF while BUSY | Upper limit signal (FLS) turned off during major positioning, OPR, or JOG operation. | The operation decelerates and stops. | Return the workpiece to a position within the stroke limit range using JOG operation. |
| | 92 | | Lower limit signal OFF while BUSY | Lower limit signal (RLS) turned off during major positioning, OPR, or JOG operation. | | |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Operation error | 93 | ERR.2 | External stop signal ON during OPR | Stop signal (STOP) turned on during OPR. | The operation decelerates and stops. | • Start OPR if the workpiece stops when the near-point dog turns on in the count method.<br>• In the near-point dog method, if the workpiece stops after the near-point dog turns on, return the workpiece to the position before the near-point dog turns on using JOG operation or major positioning, and then start OPR.<br>• Start OPR if the workpiece stops before the near-point dog turns on. |
| | 100 | ERR.1 | Outside the stroke limit range | The current value exceeded the stroke limit range during OPR or JOG operation. | The OPR or JOG operation continues. | Return the workpiece to a position within the stroke limit range using JOG operation. |
| | 102 | | STOP signal ON during OPR | Stop signal (Y27) was turned on during OPR. | The operation decelerates and stops. | • Start OPR if the workpiece stops when the near-point dog turns on in the count method.<br>• In the near-point dog method, if the workpiece stops after the near-point dog turns on, return the workpiece to the position before the near-point dog turns on using JOG operation or major positioning, and then start OPR.<br>• Start OPR if the workpiece stops before the near-point dog turns on. |
| | 103 | | PLC READY signal OFF during OPR | PLC READY signal (Y2D) was turned off during OPR. | | |
| | 104 | | Outside the command frequency range | The command frequency exceeded 4Mpulse/s due to the electronic gear setting. | The speed is limited to 4Mpulse/s or lower. | Change the speed to 4Mpulse/s or lower. |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Operation error | 105 | ERR.1 | PLC READY signal OFF during operation | PLC READY signal (Y2D) was turned off during major positioning or JOG operation. | The operation decelerates and stops. | Turn on PLC READY signal (Y2D). |
| Control change error during operation | 110 | | Current value change error | A current value change is attempted when BUSY signal (X14) is on. | The control change is ignored. | Make an interlock using a sequence program. |
| | 111 | | Speed change error (OPR) | A speed change was attempted during OPR. | | |
| | 112 | | Speed change error (Positioning) | A speed change was attempted at the start of automatic deceleration of major positioning or thereafter. | | Correct the sequence program so that the speed is changed before the start of automatic deceleration of major positioning. |
| | 113 | | Speed change error (JOG) | A speed change was attempted after JOG start signal (Y24, Y25) was turned off in JOG operation. | | Make an interlock using a sequence program. |
| | 114 | | Deviation counter clear error | Deviation counter clearing is attempted when BUSY signal (X14) is on. | | |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Zero/gain adjustment error | 120 | ERR.1 | Flash ROM write exceeded | For zero/gain adjustment, a setting value has been consecutively written to the flash ROM more than 25 times. | The zero/gain adjustment values are not reflected. | Turn off and on the power supply, or reset the CPU module or the error. |
| | 121 | | Flash ROM write error | For zero/gain adjustment, the setting value could not be written in the flash ROM. | | Try writing the value again.<br>If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative. |
| | 122 | | Zero adjustment error | For zero/gain adjustment, the zero adjustment value is equal to or greater than the gain adjustment value. | | Set the values so that they meet the following condition: Zero adjustment value < Gain adjustment value |
| | 123 | | Zero/gain adjustment setting error | The set value in "Cd.10 Zero/gain adjustment specification" is outside the setting range. | | Set a value within the setting range (1, 2) in "Cd.10 Zero/gain adjustment specification". |
| | 124 | | Zero/gain adjustment value error | The set value in "Cd.11 Zero/gain adjustment value specification" is outside the setting range. | | Set a value within the setting range (-3000 to 3000) in "Cd.11 Zero/gain adjustment value specification". |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Zero/gain adjustment error | 125 | ERR.1 | Analog output adjustment area 1 Outside the setting range | The set value in "Cd.5 Analog output adjustment area 1" is outside the setting range. | The zero/gain adjustment values are not reflected. | Set a value within the setting range.<br>[Setting range]<br>Depends on "Accumulated pulse setting" in the intelligent function module switch setting. (Unit: pulse)<br>• Selection 1: -3700 to 3700<br>• Selection 2: -7400 to 7400<br>• Selection 3: -11100 to 11100<br>• Default value, selection 4: -14800 to 14800 |
| | 126 | | Analog output adjustment area 2 Outside the setting range | The set value in "Cd.9 Analog output adjustment area 2" is outside the setting range. | | Set a value within the setting range.<br>[Setting range]<br>Depends on "Accumulated pulse setting" in the intelligent function module switch setting. (Unit: pulse)<br>• Selection 5: -37000 to 37000<br>• Selection 6: -74000 to 74000<br>• Selection 7: -111000 to 111000<br>• Selection 8: -148000 to 148000 |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Accumulated pulse error detection function error | 130 | ERR.1 | Accumulated pulse alert | Accumulated pulses reached the alert level. | The positioning continues. | — |
| | 131 | | Accumulated pulse error undetectable | • The number of accumulated pulses used as the reference of the accumulated pulse error detection function is unmeasured.<br>• Either of the values in " Cd.13 Alert output accumulated pulse setting value (maximum value)" and " Cd.14 Immediate stop accumulated pulse setting value (maximum value)" is outside the setting range. Moreover, either of the values in " Cd.15 Alert output accumulated pulse setting value (minimum value)" and " Cd.16 Immediate stop accumulated pulse setting value (minimum value)" is outside the setting range.<br>• " Cd.17 Accumulated pulse setting value selection" is set to 1 and the maximum/minimum reference values are set to 0. | The accumulated pulse error detection function is not executed. | • Measure the reference value and then, execute the accumulated pulse error detection function.<br>• Set the values of " Cd.13 Alert output accumulated pulse setting value (maximum value)" to " Cd.16 Immediate stop accumulated pulse setting value (minimum value)" within the setting range.<br>• Change the value of " Cd.17 Accumulated pulse setting value selection" to 0 and review the setting values of " Cd.13 Alert output accumulated pulse setting value (maximum value)" to " Cd.16 Immediate stop accumulated pulse setting value (minimum value)". |
| | 132 | | Reference value write error | " Cd.20 Reference value write request" was set to 1 when the measurement was not being executed (" Md.20 Reference value measurement flag" was set to 0). | The reference value is not written to the flash ROM. | Measure the reference value and then, write the value. (Write the value when " Md.20 Reference value measurement flag" is set to 1.) |

| Error category | Error code (decimal) | Error classification | Error name | Description | Operation at the error occurrence | Action |
|---|---|---|---|---|---|---|
| Accumulated pulse error detection function error | 133 | ERR.1 | Flash ROM write exceeded | The measured reference value has been consecutively written to the flash ROM more than 25 times. | The measured reference value is not saved in the flash ROM. | Turn off and on the power supply or reset the CPU module, or clear the error. |
| | 134 | | Flash ROM write error | The measured reference value could not be written in the flash ROM. | | Write the value again. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative. |
| I/F error | 800 | ERR.2 | Hold error | The setting for the QD73A1 is "Hold" on a CPU module's parameter "Error Time Output Mode". | The module does not operate. | Set "Clear" to the CPU module's parameter "Error Time Output Mode". |
| | 803 | | Programmable controller CPU error | The CPU has a problem. | At start: The module does not operate. During operation: The operation decelerates and stops. | Check the error occurring on the CPU module, and refer to the user's manual for the CPU module used. |
| Fatal error | 900 | | Hardware error 1 | The hardware has a problem. | The system stops. | Turn off and on the power supply. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative. |
| | 999 | | Hardware error 2 | | | |

# APPENDICES

## Appendix 1 Functions Added or Changed

### Appendix 1.1 Functions added

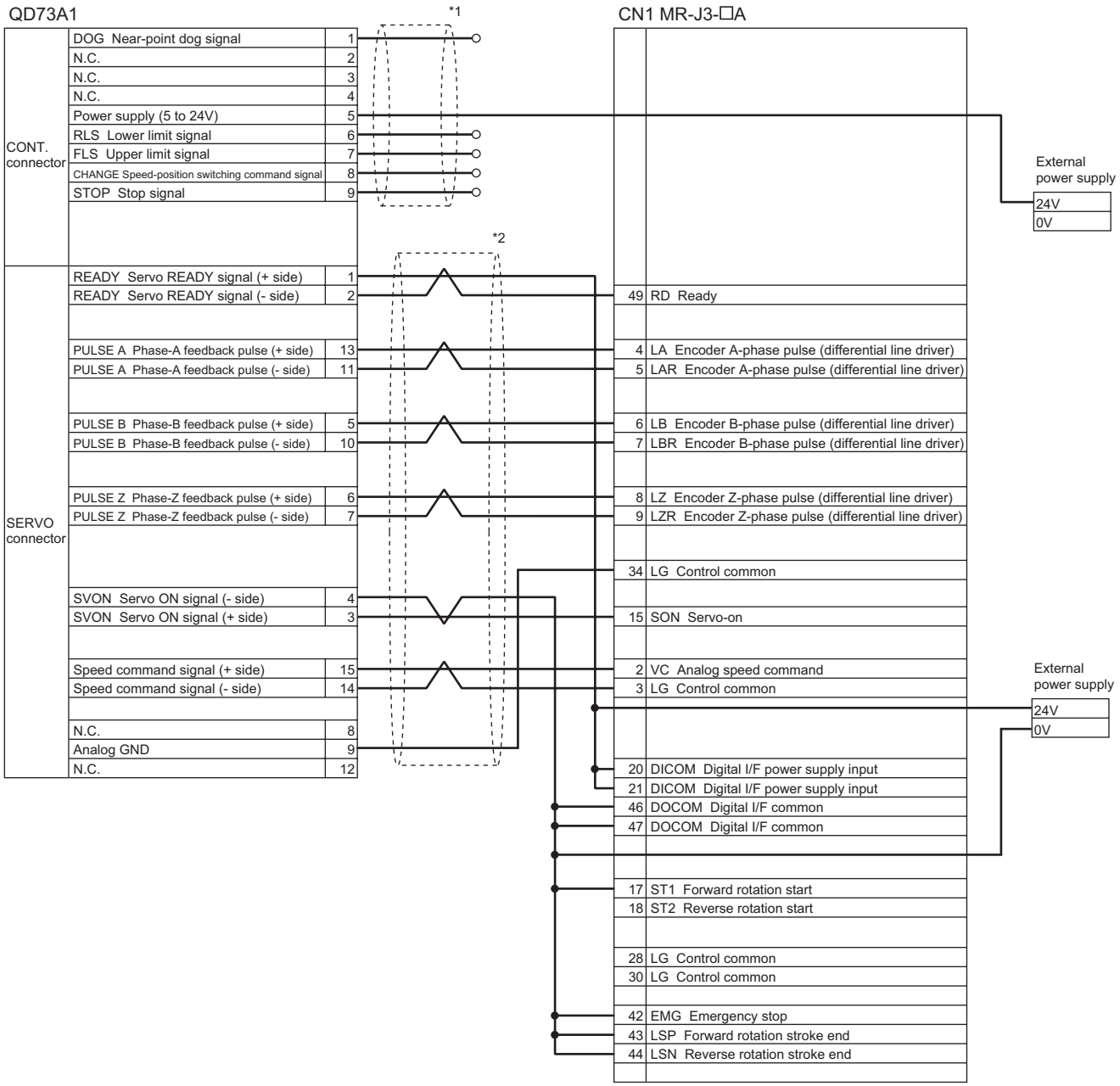
The following lists the function added to the QD73A1 and corresponding product information.

| Function | QD73A1 product information (first five digits) | Reference |
|---|---|---|
| Accumulated pulse error detection function | 14082 or later | Page 221, Section 11.9 |

# Appendix 2 Connection Examples

## Appendix 2.1 Example of connection with a servo amplifier manufactured by Mitsubishi Electric Corporation

### (1) Connection with MR-J3□A (Differential driver)

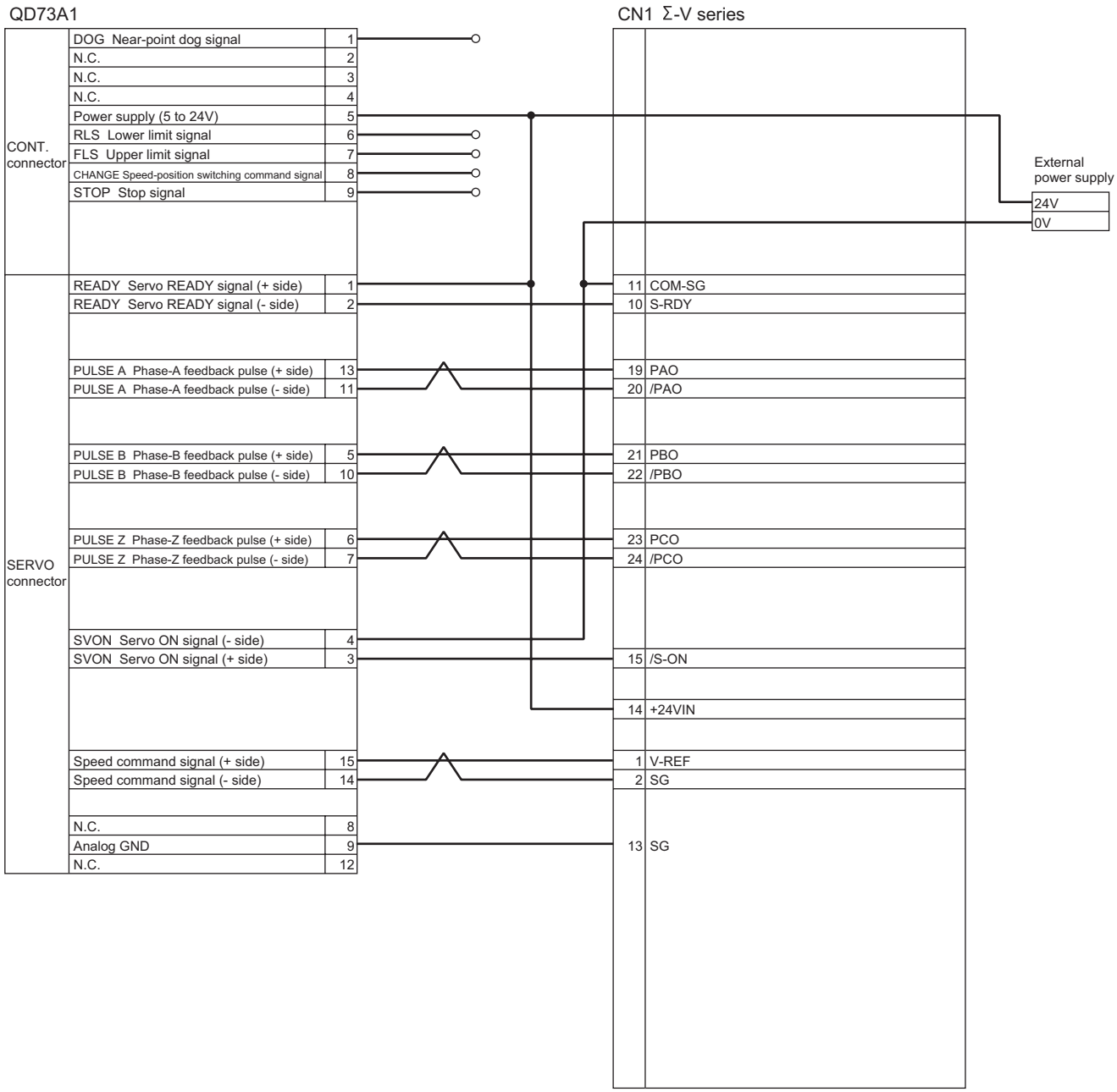

QD73A1
*1
CN1 MR-J3-□A
CONT. connector
DOG Near-point dog signal 1
N.C. 2
N.C. 3
N.C. 4
Power supply (5 to 24V) 5
RLS Lower limit signal 6
FLS Upper limit signal 7
CHANGE Speed-position switching command signal 8
STOP Stop signal 9
External power supply
24V
0V
*2
SERVO connector
READY Servo READY signal (+ side) 1
READY Servo READY signal (- side) 2
49 RD Ready
PULSE A Phase-A feedback pulse (+ side) 13
PULSE A Phase-A feedback pulse (- side) 11
4 LA Encoder A-phase pulse (differential line driver)
5 LAR Encoder A-phase pulse (differential line driver)
PULSE B Phase-B feedback pulse (+ side) 5
PULSE B Phase-B feedback pulse (- side) 10
6 LB Encoder B-phase pulse (differential line driver)
7 LBR Encoder B-phase pulse (differential line driver)
PULSE Z Phase-Z feedback pulse (+ side) 6
PULSE Z Phase-Z feedback pulse (- side) 7
8 LZ Encoder Z-phase pulse (differential line driver)
9 LZR Encoder Z-phase pulse (differential line driver)
34 LG Control common
SVON Servo ON signal (- side) 4
SVON Servo ON signal (+ side) 3
15 SON Servo-on
Speed command signal (+ side) 15
Speed command signal (- side) 14
2 VC Analog speed command
3 LG Control common
External power supply
24V
0V
N.C. 8
Analog GND 9
N.C. 12
20 DICOM Digital I/F power supply input
21 DICOM Digital I/F power supply input
46 DOCOM Digital I/F common
47 DOCOM Digital I/F common
17 ST1 Forward rotation start
18 ST2 Reverse rotation start
28 LG Control common
30 LG Control common
42 EMG Emergency stop
43 LSP Forward rotation stroke end
44 LSN Reverse rotation stroke end

*1 indicates use of shielded cables. Use shielded cables for wiring.

*2 indicates use of shielded twisted pair cables. Use shielded twisted pair cables for wiring.

# Appendix 2.2 Example of connection with a servo amplifier manufactured by YASKAWA Electric Corporation

## (1) Connection with Σ-V series (Differential driver)



# Appendix 3 Comparison of the QD73A1 and the AD70/A1SD70

## (1) Performance specification comparison

| Item | | Specifications | | |
|---|---|---|---|---|
| | | QD73A1 | AD70 | A1SD70 |
| Number of occupied I/O points | | 48 points (I/O assignment: empty 16 points and intelligent 32 points) | 32 points (special 32 points) | 48 points (I/O assignment: empty 16 points and special 32 points) |
| Positioning | Speed command | 1 to 4000000(pulse/s) | 1 to 400000(pulse/s) | |
| | In-position range | 1 to 20479pulse | 1 to 2047pulse | |
| Positioning feedback pulse input | Pulse frequency | Open collector: 200kpulse/s<br>TTL: 200kpulse/s<br>Differential output: 1Mpulse/s | Open collector: 100kpulse/s<br>TTL: 100kpulse/s<br>Differential output: 100kpulse/s | |
| OPR control | | With OPR address change<br><br>OPR method and OPR direction depend on the parameter setting. | With OPR address change<br><br>OPR method and OPR direction depend on the switch setting. | |
| Internal current consumption | | 5VDC 0.52A | 5VDC 0.3A | |
| External supply voltage/current terminal block | | No external power supply | +15VDC 0.2A, -15VDC, 0.02A | |
| External dimensions | | 98(H)mm × 55.2(W)mm × 90(D)mm | 250(H)mm × 37.5(W)mm × 119(D)mm | 130(H)mm × 69.5(W)mm × 93.6(D)mm |
| Weight | | 0.20kg | 0.5kg | 0.4kg |
| Starting time<br>(from a start request to analog output start) | | Absolute system: 1.2ms (same for two-phase trapezoidal positioning)<br>Incremental system: 1.2ms (same for two-phase trapezoidal positioning)<br>JOG operation: 1.2ms<br>OPR (near-point dog method): 1.2ms<br>OPR (count method): 1.2ms | Absolute system: 4.4ms (additional 0.2ms for two-phase trapezoidal positioning)<br>Incremental system: 4.5ms (additional 0.2ms for two-phase trapezoidal positioning)<br>JOG operation: 4.3ms<br>OPR (near-point dog method): 4.4ms<br>OPR (count method): 5.1ms | |

| Item | Specifications | | |
|---|---|---|---|
| | QD73A1 | AD70 | A1SD70 |
| LED | RUN | None | |
| | ERR. | ERR.1/ERR.2 (Minor/major error) | |
| | ZERO | None | |
| | GAIN | None | |
| | None (check with X signal) | SV RDY (Servo READY signal) | |
| | None (check with X signal) | DOG (Near-point dog signal) | |
| | None (check with X signal) | STOP (Stop signal) | |
| | None (check with X signal) | FLS (Upper limit signal) | |
| | None (check with X signal) | RLS (Lower limit signal) | |
| | None (check with X signal) | IN-POS. (In-position) | |
| | None (check in the buffer memory) | POLE (Deviation counter polarity) | |
| | None (check in the buffer memory) | $2^N$ (Deviation counter value) | |
| | None (check with Y signal) | PC RDY (PLC READY signal) | |
| | None (check with X signal) | ZERO (OPR request signal) | |
| | None (check with X signal) | EEX (Excessive error) | |
| | None (check with X signal) | WDT ERR. (Hardware error) | |
| | None (check with X signal) | V-MODE (Operating status) | |
| Zero/gain adjustment | • Adjustment using the UP/DOWN switch<br>• Adjustment using the buffer memory | Adjustment using volumes | |
| Mode switch | Intelligent function module switch | DIP switch | |

All the other specifications are the same.

## (2) Function comparison

○: Usable ×: Unusable

| Function | | | QD73A1 | AD70/A1SD70 | Difference |
|---|---|---|---|---|---|
| OPR control | | | ○ | ○ | — |
| Major positioning control | Position control mode | Positioning control | ○ | ○ | [Buffer memory addresses for positioning data]<br>Refer to the following.<br>☞ Page 269, Appendix 3 (5) |
| | | Two-phase trapezoidal positioning control | ○ | ○ | |
| | Speed-position control switch mode | | ○ | ○ | [Buffer memory addresses for positioning data]<br>Refer to the following.<br>☞ Page 269, Appendix 3 (5)<br>[New speed-position movement amount (buffer memory)]<br>• QD73A1: The setting is cleared to 0 when the next operation starts.<br>• AD70/A1SD70: The value written during speed control is reflected.<br>[Stroke limit range]<br>• QD73A1: 1 to 2147483647<br>• AD70/A1SD70: Stroke limit lower limit to upper limit |
| JOG operation | | | ○ | ○ | — |
| Electronic gear function | | | ○ | ○ | — |
| Speed limit function | | | ○ | ○ | — |
| Stroke limit function | | | ○ | ○ | — |
| Upper limit switch (FLS)/lower limit switch (RLS) function | | | ○ | ○ | — |
| Current value change function | | | ○ | ○ | [Procedure]<br>• QD73A1: The current value can be changed by setting "1" in "Current value change request".<br>• AD70/A1SD70: The current value can be changed by writing a new current value in the buffer memory. |
| Speed change function | | | ○ | ○ | [Procedure]<br>• QD73A1: Speed can be changed by setting "1" in "Speed change request".<br>• AD70/A1SD70: Speed can be changed by writing a new speed value in the buffer memory. |
| Deviation counter clear function | | | ○ | ○ | — |
| In-position function | | | ○ | ○ | — |
| Multiplication setting | | | ○ | ○ | — |
| Accumulated pulse error detection function | | | ○ | × | — |
| Zero/gain adjustment | | | ○ | ○ | [Method]<br>• QD73A1: Switches on the front of the QD73A1 or a sequence program<br>• AD70/A1SD70: Switches on the AD70/A1SD70 |
| Module status monitor function | | | ○ | × | — |
| Error history function | | | ○ | × | — |
| Module error collection function | | | ○ | × | — |
| Error clear function | | | ○ | × | — |

**Remark**

Positioning execution time (BUSY signal (X14) ON to Positioning complete signal (X15) ON) of the QD73A1 and AD70/A1SD70 may be different since their internal processing methods are different.
As a result, the timing when In-position signal (X16) turns on may also vary.
Adjust positioning execution time using the following methods if the difference of the execution time (or the timing when In-position signal (X16) turns on) affects the system.

- Adjusting the QD73A1's positioning parameter "Pr.6 Acceleration time" or "Pr.7 Deceleration time"
- Increasing gain by changing the accumulated pulse amount setting through the QD73A1's zero/gain adjustment

### (3) Error code comparison

○: Usable ×: Unusable

| Error code | Error name | QD73A1 | AD70/A1SD70 |
|---|---|---|---|
| 60 | Write in the buffer memory prohibited | × | ○ |
| 61 | | × | ○ |
| 62 | | × | ○ |
| 86 | Mode setting error | × | ○ |
| 120 | Flash ROM write exceeded | ○ | × |
| 121 | Flash ROM write error | ○ | × |
| 122 | Zero adjustment error | ○ | × |
| 123 | Zero/gain adjustment setting error | ○ | × |
| 124 | Zero/gain adjustment value error | ○ | × |
| 125 | Analog output adjustment area 1 Outside the setting range | ○ | × |
| 126 | Analog output adjustment area 2 Outside the setting range | ○ | × |
| 130 | Accumulated pulse alert | ○ | × |
| 131 | Accumulated pulse error undetectable | ○ | × |
| 132 | Reference value write error | ○ | × |
| 133 | Flash ROM write exceeded | ○ | × |
| 134 | Flash ROM write error | ○ | × |
| 800 | Hold error | ○ | × |
| 803 | Programmable controller CPU error | ○ | × |
| 900 | Hardware error 1 | ○ | × |
| 999 | Hardware error 2 | ○ | × |

All the other error codes are the same.

## (4) Input (X)/output (Y) comparison

○: Usable ×: Unusable

| Device No.*1 | Signal name | QD73A1 | AD70/A1SD70 |
|---|---|---|---|
| X20 | OPR start complete signal | ○ | × |
| X21 | Absolute positioning start complete signal | ○ | × |
| X22 | Forward start complete signal | ○ | × |
| X23 | Reverse start complete signal | ○ | × |
| X24 | Synchronization flag | ○ | × |
| X2A | Zero/gain adjustment data writing complete flag | ○ | × |
| X2B | Zero/gain adjustment change complete flag | ○ | × |
| X2C | Set value change complete flag | ○ | × |
| X2D | Operating status of the speed-position control switch mode | ○ | × |
| Y1A | Zero/gain adjustment data writing request signal | ○ | × |
| Y1B | Zero/gain adjustment change request signal | ○ | × |
| Y1C | Set value change request signal | ○ | × |

*1 For assignment to X/Y10 to X/Y2F

All the other I/O signals are the same.

## (5) Buffer memory address comparison

| Buffer memory area name | Buffer memory address (decimal) | |
|---|---|---|
| | QD73A1 | AD70/A1SD70 |
| Current value change request | 90 | — |
| Speed change request | 91 | — |
| Analog output adjustment area 2 | 92 | — |
| | 93 | — |
| Zero/gain adjustment specification | 94 | — |
| Zero/gain adjustment value specification | 95 | — |
| Factory default zero/gain adjustment value restoration request | 96 | — |
| Zero/gain execution status | 112 | — |
| Zero/gain adjustment status | 113 | — |
| Feedrate | 114 | — |
| | 115 | — |
| Error history (0 to 16) | 120 to 183 | — |
| Error history pointer | 184 | — |
| Maximum accumulated pulse value | 200 | — |
| | 201 | — |
| Minimum accumulated pulse value | 202 | — |
| | 203 | — |
| Accumulated pulse error detection function status | 204 | — |
| Reference value measurement flag | 205 | — |
| Positioning pattern | 301 | 60 |
| Positioning address P1 | 302 | 61 |
| | 303 | 62 |
| Positioning speed V1 | 304 | 63 |
| | 305 | 64 |
| Positioning address P2 | 306 | 65 |
| | 307 | 66 |
| Positioning speed V2 | 308 | 67 |
| | 309 | 68 |
| Alert output accumulated pulse setting value (maximum value) | 400 | — |
| | 401 | — |
| Immediate stop accumulated pulse setting value (maximum value) | 402 | — |
| | 403 | — |
| Alert output accumulated pulse setting value (minimum value) | 404 | — |
| | 405 | — |
| Immediate stop accumulated pulse setting value (minimum value) | 406 | — |
| | 407 | — |
| Accumulated pulse setting value selection | 408 | — |
| Accumulated pulse error detection request | 409 | — |
| Measurement start request | 410 | — |
| Reference value write request | 411 | — |

All the other buffer memory addresses are the same.

### (6) External I/O signal comparison

| Input/output | Signal name | | Description | |
|---|---|---|---|---|
| | | | QD73A1 | AD70/A1SD70 |
| Input | Power supply | Terminal block | None | ±15VDC (±14.55 to ±15.45V) |
| Output | (Open collector method)<br>Phase-A feedback pulse (PULSE A)<br>Phase-B feedback pulse (PULSE B)<br>Phase-Z feedback pulse (PULSE Z) | | • Pulse frequency: 200kpulse/s or less<br>• ON voltage: 4V or higher<br>• OFF voltage: 1V or lower | • Pulse frequency: 100kpulse/s or less<br>• ON voltage: 4V or higher<br>• OFF voltage: 1V or lower |
| | (TTL method)<br>Phase-A feedback pulse (PULSE A)<br>Phase-B feedback pulse (PULSE B)<br>Phase-Z feedback pulse (PULSE Z) | | • Pulse frequency: 200kpulse/s or less<br>• ON voltage: 2.8V or higher<br>• OFF voltage: 0.8V or lower | • Pulse frequency: 100kpulse/s or less<br>• ON voltage: 2.8V or higher<br>• OFF voltage: 0.8V or lower |
| | (Differential output method)<br>Phase-A feedback pulse (PULSE A)<br>Phase-B feedback pulse (PULSE B)<br>Phase-Z feedback pulse (PULSE Z) | | Pulse frequency: 1Mpulse/s or less | Pulse frequency: 100kpulse/s or less |

All the other external I/O signals are the same.

# Appendix 4 When Using GX Developer

This section describes the operating procedure of GX Developer.

### (1) Applicable software versions

For applicable software versions, refer to the following.

☞Page 23, Section 2.1 (4)

# Appendix 4.1 Operation of GX Developer

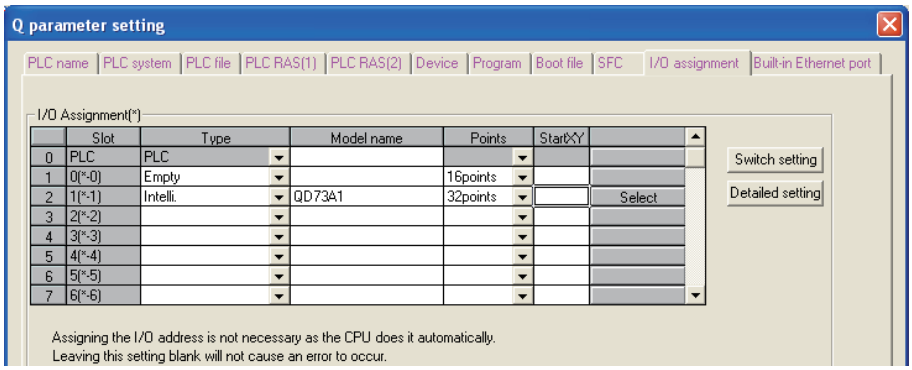
Configure the following settings when using GX Developer.

| Window name | Application | Reference |
|---|---|---|
| I/O assignment | Set the type of the module to be mounted and the I/O signal range. | Page 271, Appendix 4 (1) |
| Intelligent function module switch setting | Configure the switch setting of the intelligent function module. | Page 272, Appendix 4 (2) |

### (1) I/O assignment

Configure the setting on "I/O assignment" in "PLC parameter".

Parameter ⇨ [PLC parameter] ⇨ [I/O assignment]

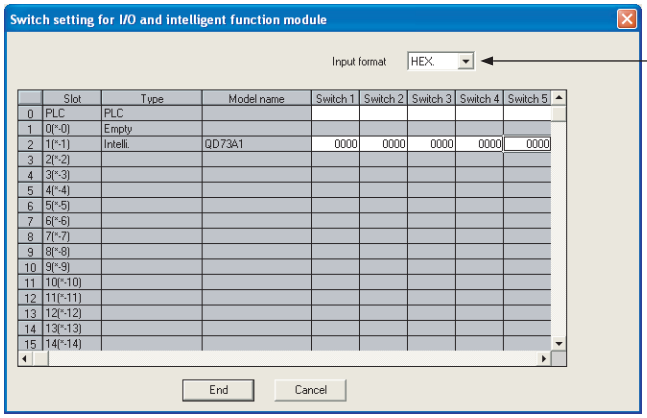



| Item | Description |
|---|---|
| Type | Select "Intelli.". |
| Model name | Enter the model name of the module. |
| Points | The QD73A1 uses two slots. Select "Empty" and "0point" or "16points" for the first slot. Select "Intelli." and "32points" for the second slot. |
| StartXY | Enter any start I/O number of the QD73A1. |

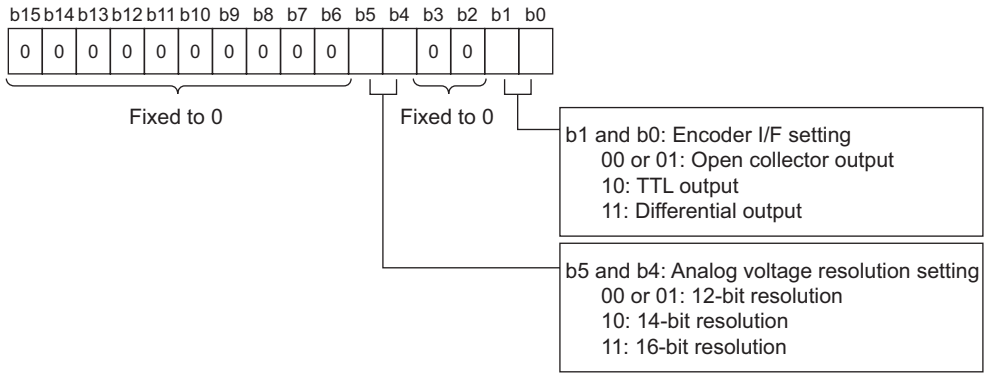
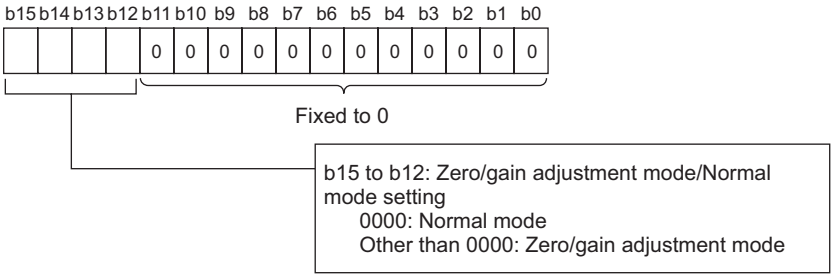
## (2) Intelligent function module switch setting

Configure the setting on "Switch setting" in "PLC parameter".

Parameter ⇨ [PLC parameter] ⇨ [I/O assignment] ⇨ Click the Switch setting button.




| Item | Setting detail | | | | |
|---|---|---|---|---|---|
| Switch 1 | Bit | | | | |
| | b0 | | | | Rotation direction setting |
| | 0 | | | | Positive voltage is output when the positioning address increases. |
| | 1 | | | | Negative voltage is output when the positioning address increases. |
| | b3 | | b2 | b1 | — |
| | 0 | | 0 | 0 | Fixed to 0 (Empty)<br>When a value is set, the value is ignored. |
| | b7 | b6 | b5 | b4 | Accumulated pulse setting (unit: pulse) |
| | 0 | 0 | 0 | 0 | -14800 to 14800 (default value) |
| | 0 | 0 | 0 | 1 | -3700 to 3700 [Selection 1] |
| | 0 | 0 | 1 | 0 | -7400 to 7400 [Selection 2] |
| | 0 | 0 | 1 | 1 | -11100 to 11100 [Selection 3] |
| | 0 | 1 | 0 | 0 | -14800 to 14800 [Selection 4] |
| | 0 | 1 | 0 | 1 | -37000 to 37000 [Selection 5] |
| | 0 | 1 | 1 | 0 | -74000 to 74000 [Selection 6] |
| | 0 | 1 | 1 | 1 | -111000 to 111000 [Selection 7] |
| | 1 | 0 | 0 | 0 | -148000 to 148000 [Selection 8] |
| | b9 | | b8 | | Multiplication setting |
| | 0 | | 0 | | 4 |
| | 0 | | 1 | | 2 |
| | 1 | | 0 | | 1 |
| | 1 | | 1 | | 1/2 |
| | b11 | | b10 | | — |
| | 0 | | 0 | | Fixed to 0 (Empty)<br>When a value is set, the value is ignored. |
| | b12 | | | | OPR direction setting |
| | 0 | | | | Reverse direction (address decreasing) |
| | 1 | | | | Forward direction (address increasing) |
| | b13 | | | | OPR method setting |
| | 0 | | | | Near-point dog method |
| | 1 | | | | Count method |
| | b15 | | b14 | | — |
| | 0 | | 0 | | Fixed to 0 (Empty)<br>When a value is set, the value is ignored. |

| Item | Setting detail |
|---|---|
| Switch 2 | Encoder I/F setting and Analog voltage resolution setting<br>  <br><br>"00 or 01" means that the setting is valid with either value.<br>When a value is set in b15 to b6, b3, or b2, the value is ignored. |
| Switch 3 | Fixed to 0 (Empty)<br>When a value is set, the value is ignored. |
| Switch 4 | Zero/gain adjustment mode/Normal mode setting<br>  <br><br>When a value is set in b11 to b0, the value is ignored. |
| Switch 5 | Fixed to 0 (Empty)<br>When a value is set, the value is ignored. |

# Appendix 5 Terms

## (1) Encoder

One of the pulse generators that converts input data into binary data (on and off)

## (2) Near-point dog

A switch used in positioning systems, which is placed before the original point of a workpiece. When this switch turns on, the feedrate is switched to creep speed. Therefore, there is time required for the deceleration from the federate to the creep speed while this switch is on.

## (3) Servo on

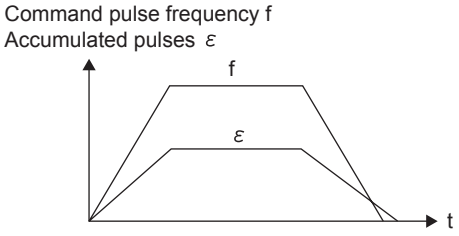
A signal that indicates the normal status of a servo amplifier. A servo amplifier is operable only when it is normal and this signal is on.

## (4) Servomotor

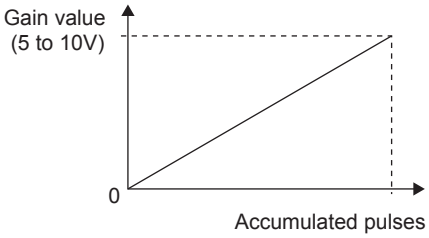
A motor that rotates according to a command. This motor is highly responsive, therefore frequent and rapid start and stop are available with high precision. DC and AC type motors are available as well as high power motors. Feedback control is available with the included pulse generator that detects the number of rotations.

## (5) Accumulated pulse

Pulses that are accumulated in the deviation counter inside the QD73A1. The difference between command pulses and feedback pulses becomes accumulated pulses.
Accumulated pulses that are proportional to the command pulse frequency are constantly output while the QD73A1 is operating. The number of accumulated pulses becomes "0" when positioning is completed.




The analog output voltage value from the QD73A1 is proportional to the number of accumulated pulses.



### (6) Drive unit (servo amplifier)

A generic term for drive units that support analog voltage inputs. The commands that are output from the QD73A1 are low voltage. This unit is used to amplify the energy and activate a motor. The unit, also called a servo amplifier, is an accessory on a servomotor.

### (7) Pulse generator

A device that generates pulses. For example, by attaching this device on a motor axis, pulses can be generated by the rotation of the axis.

### (8) Feedback pulse

Pulses that are fed back from the encoder to the QD73A1 according to the motor's actual rotation amount (rotation degree)

### (9) Deviation counter

A counter that counts up and down the difference between the number of command pulses and feedback pulses. The difference between command pulses and feedback pulses are accumulated in the deviation counter as "accumulated pulses". The number of accumulated pulses in the deviation counter becomes "0" when positioning is completed.

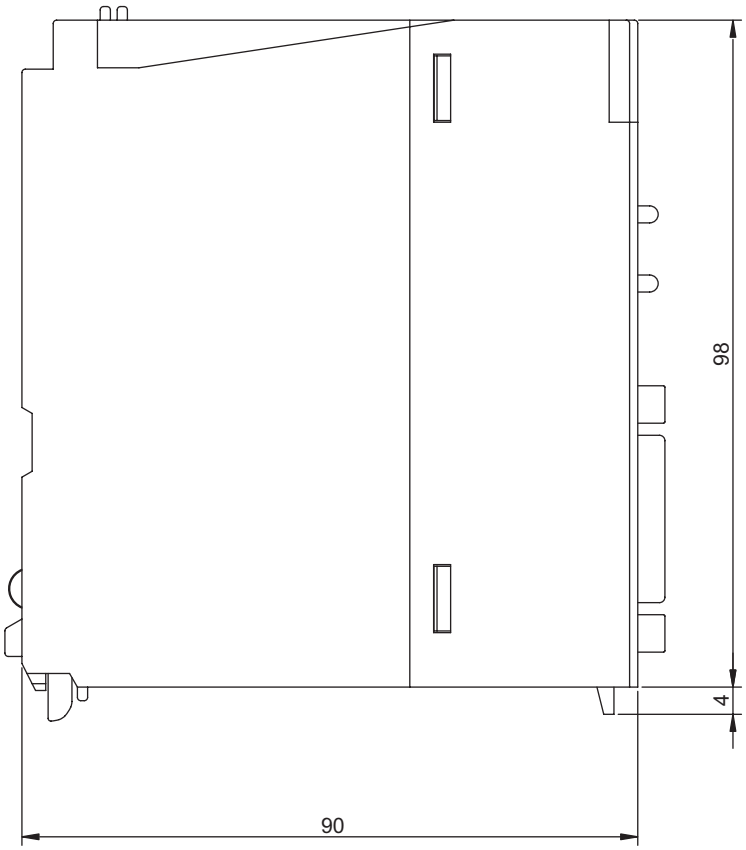
### (10) Zero signal

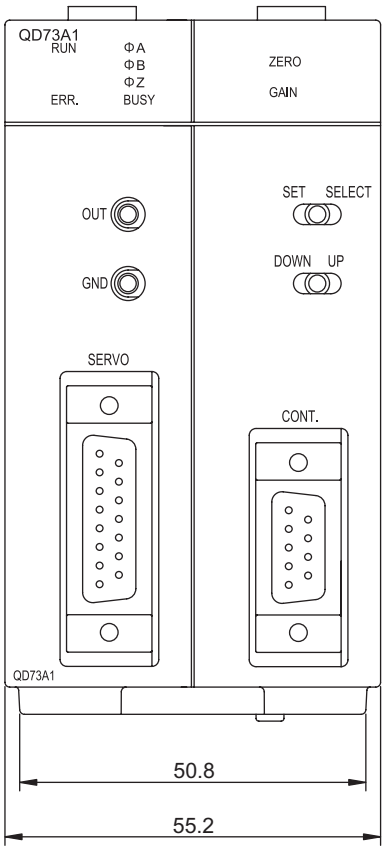
PG0 of a pulse generator (encoder), that is detected once in one rotation

### (11) Workpiece

A generic term for various objects being controlled, including moving objects such as tools

# Appendix 6 External Dimensions




(Unit: mm)

# Memo

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# REVISIONS

*The manual number is given on the bottom left of the back cover.

| Print date | *Manual number | Revision |
|---|---|---|
| July 2012 | SH(NA)-081075ENG-A | First edition |
| November 2012 | SH(NA)-081075ENG-B | The accumulated pulse error detection function is added. |
| | | |

Japanese manual version SH-081074-D

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# MELSEC-Q QD73A1 Positioning Module User's Manual

| | |
|---|---|
| MODEL | QD73A1-U-E |
| MODEL CODE | 13JZ69 |
| SH(NA)-081075ENG-B(1211)MEE | |

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